Electrical World and Engineer

THE CONSOLIDATION OF "THE ELECTRICAL WORLD" AND "ELECTRICAL ENGINEER."

VOL. XXXVIII. NEW YORK, SATURDAY, AUGUST 10, 1901. No. 6.

ELECTRICAL WORLD AND ENGINEER

(INCORPORATED.)

120 LIBERTY STREET, NEW YORK.

TELEPHONE CALL: 4044 CORTLANDT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

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ELECTRICAL WORLD AND ENGINEER.

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United States, Canada or Mexico, - - - - - - - - - - per year, $3.00
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Entered as second-class mail matter at the New York Post Office.

NEW YORK, SATURDAY, AUGUST 10, 1901.

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THE INSTITUTE MEETING.

In accordance with the arrangements which have been carefully made by various committees, the American Institute of Electrical Engineers will begin its New York-Buffalo meeting next week. The programme is of a varied character, both in its papers and its entertainments, while the presence of many foreign engineers and the visit to the Pan-American give a marked flavor of novelty to the whole affair. Remembering the cordial hospitality shown to it abroad last year, the Institute proposes to make its guests from Europe thoroughly at home in this country, and we are glad to learn that the contributions of members to the reception and entertainment fund are already of a most liberal and substantial nature.

There is great good in technical meetings, and particularly in those of an international kind. In electricity the activity is world-wide, and everywhere acute minds are at work upon its philosophical and engineering problems. That the workers and thinkers from all countries should thus get together and exchange ideas and experience is excellent, and we believe the present meeting will in this manner be productive of great benefit. Aside from the instructive aspect, there will be the renewal of many old friendships, and the international acquaintances formed will, as usual, add to the pleasure of the occasion. We trust the attendance, both in New York and in Buffalo, will be large. The programmes are now in the hands of all, and were noted in these pages last week, so that we need not again point out how worth while it is for every member who can manage it to participate.

TRACTION PROBLEMS.

We publish a most interesting article this week by Mr. F. H. Shepard on the operating features of the Boston elevated road, to which attention was duly drawn by us on the occasion of its opening last June. Mr. Shepard, who has been intimately associated with the engineering and installation work on the road throws light upon the peculiar nature of many of the problems to be met, and gives some valuable data as to the conditions that have developed since the line started. We are sure that all who read his pithy article will agree that in view of the nature of the line, and the heavy service required, electricity has proved remarkably successful in its application to the work. The results accomplished by Vice-President Sergeant and his staff are full of encouragement as to what may be expected when at last the Manhattan Elevated gets into operation with electric power.

When we recall how long it took to convince some of the Manhattan powers that electricity was adequate to the work now done by the objectionable steam locomotives, and when we note the changed situation here and in Boston—not forgetting Chicago—there is reason to believe that in due course the great New York Central Railroad will become convinced that electricity can redeem its tunnel terminal in New York City from the deserved odium that steam traction has at last brought upon it. We are not inclined, as are some of the critics of the New York Central, to belittle the problem. It is a serious one. Nor, like some other critics, do we deem it fair to throw doubt on the good faith of the officials in the matter. But it does seem a great pity that the question should have got before the Grand Jury before the company allowed it to be seen that it was actually endeavoring to effect an improvement—such an improvement, in short, as only electricity can bring. For even when the

work of abandoning steam for electricity is begun, much time must elapse before it can be completed, and meanwhile there can be little mitigation in discomfort for those who use the tunnel daily.

THE JOSSE BINARY VAPOR ENGINE.

We print elsewhere an article compiled from a report describing a type of so-called "waste heat" engine as developed by Professor E. Josse, of the Royal Technical High School, of Berlin-Charlottenberg. The fundamental purpose of such an engine is to take the heat which an ordinary steam engine rejects and utilize a portion of it for the doing of useful work, thus increasing the total useful product without any increase in the initial supply of heat. This is most conveniently accomplished, as explained in the article, by the use of a second substance for which the exhaust from the steam engine may serve as a source of heat, and which will become thereby vaporized under a pressure suitable for use. In the present case sulphur dioxide or SO_2 is the substance thus employed, the condenser for the steam engine serving as the vaporizer or boiler for the SO_2, the vapor thus produced being used in a cycle of its own, as explained.

The possibilities of this combination of two or more substances in one thermodynamic process have long been known, and so-called "binary vapor" engines are by no means a new thing. Their principles, however, have not always been clearly understood, and it has sometimes been imagined that through such a combination and in some mysterious way the second law of thermodynamics might be evaded, or that in some way the principles involved and mode of action are different from those of the more familiar steam engine. As a matter of fact, however, the principles involved are exactly those which govern the steam engine, and the same laws serve to explain the operation and limitations of one as well as the other. We have simply to recall the expression for the efficiency of an ideal or Carnot cycle heat engine. This is expressed as a fraction, the numerator of which is the temperature range through which the substance works in its cycle, and the denominator is the absolute temperature at which the heat is received into the engine. If T_1 denotes the upper and T_2 the lower limit of temperature, it is clear that if the temperature range $(T_1 - T_2)$ is widened by decreasing T_2, the efficiency of the operation will thereby be increased, and the useful work done will be greater for the same initial expenditure of heat. This is exactly what the binary vapor system proposes to do. It proposes to lower the temperature at which the heat is finally rejected from the engine, and thus to gain in efficiency in accordance with the expression above. In the actual engine, however, the full measure of the efficiency indicated by this expression is never realized, owing to various losses, chief among which is cylinder condensation. It is not enough, therefore, simply to increase the temperature range of a heat engine. We must at the same time make sure that the gain in efficiency, or at least a fair share of it, may actually be realized; that is, that some loss is not thereby introduced which will offset the ideal gain.

In the present case and by the process as described, the temperature T_2 is lowered from about 140 F. to, say, 70 F., or through a range of about 70 degs. Now, it should be clearly understood that in an ideal engine this range of 70 degs. would be worth as much in one place as another, and that in such an engine there would be no reason for coupling it up with a second cycle using a different substance. But the temperature range with steam cannot practically be extended down to 70 F., first, because to expand steam from 140 F. to 70 F. would require an additional expansion of over seven times. That is, there would be required a corresponding and enormous increase in low-pressure cylinder capacity in order to effect the expansion required. This is clearly out of the question. Secondly, when the temperature is carried down much below the limits now employed, the loss due to cylinder condensation becomes excessive, and experience indicates that with such excessive expansion in a steam engine the resulting loss due to added cylinder condensation would more than offset any gain expected. The use of steam over the lower part of the range is, therefore, impracticable for these two very good reasons. Assuming the upper limit of steam pressure fixed, we must, therefore, seek elsewhere for a substance with suitable properties in order to reduce the lower limit, and according to the claims made in the report, sulphur dioxide admirably fulfills the two fundamental requirements. That is, it has a convenient pressure and range of expansion for the temperature involved, and the cylinder condensation is quite small.

The surprising and perhaps the most significant feature of the results in the present case is found in the indication that what may be called the operative efficiency of the cycle is greater for the SO_2 than for the steam. That is, that the former comes nearer to realizing its full efficiency than the latter, and that a temperature range of one degree is worth more in the SO_2 engine than in the steam engine, whereas in an ideal engine a range of one degree is worth the same, no matter where on the scale it occurs. Indeed, it would result from this that the efficiency of the combination would be increased by increasing the range of the SO_2 engine and decreasing that of the steam engine. Mention is made in the report of certain tests which showed that such was the case for a very moderate decrease in the vacuum carried in the steam condenser and consequent rise in the temperature dividing the two cycles. It will be of much interest to learn through wider experiment the result of an increase in the initial temperature of the SO_2 as high as the practicable pressure may permit, and the corresponding increase in the range given to this part of the combination.

The use of superheated steam for raising the upper temperature and thus widening the range at the top, is now a well-assured feature of modern practice, especially in Continental Europe. The possibility of another considerable gain at the bottom of the range by decreasing the lower temperature, as indicated in this report, is such as to merit the careful attention of all concerned with the great problem of the economical development of power. As stated before, however, this possibility is one which has long been known, but the great difficulty has been to realize it in the face of the many practical difficulties that have been encountered with binary vapor engines. During the past century this type of engine has been the subject of numerous costly experiments, and while the report of Professor Josse indicates gratifying progress, the test of extended trial in practical service is lacking. As to the fluid employed by Professor Josse, we have vividly in mind a rust pile which, on a visit a year previously, had been a beautiful SO_2 refrigerating machine.

POPULAR SCIENCE AND CORPUSCLES.

In the current number of our esteemed contemporary, the *Popular Science Monthly*, which is, alas! more popular than scientific in the single particular that its pages lie largely sealed from mortal eye until separated by that anachronous atrocity—the paperknife—appears a delightful article by Professor J. J. Thomson, "On Bodies Smaller Than Atoms," an abstract of which appears in the Digest. It is a commentary upon the spread of technical education that a paper on this most abstruse subject, and actually containing some little algebra, should find the light of day in popularized literature, and awake a gleam of recognition from the eyes of many who are

not scientists. Twenty years ago such an article on such a subject would have lain on popular benches as caviare to the multitude. It is difficult to say which commands our admiration the more—the article itself, or the fact that the great world should be capable of admitting it into semi-popular literature. Either consideration presents a triumph, the one over inanimate, the other animate, nature.

There is no one so well fitted to write upon sub-atomic matter as Professor Thomson, for in a large measure he has discovered subatomland. The story of that region and the scientific inroads which have been made into it are, when properly interpreted, more entrancing than the story of the early crusades, and more astounding than those of the Arabian Nights. In about a dozen pages this great physicist expounds the salient features of the knowledge already acquired in this most recondite subject. When physicists announced that according to their calculations there were about 20,000,000,000,000,000,000 of molecules in a cubic centimeter of gas at standard pressure and temperature, it was regarded as a hazardous guess by the rank and file of technologists, in view of the fact that such minute quantities of matter were individually far beneath the cognizance and appreciation of our senses, even with the aid of the most powerful microscope. In the case of hydrogen, Professor Thomson points out the experimental reasons for believing that instead of the molecule and its constituent atoms being the smallest entities known to science, we must admit that corpuscles of matter are capable of having an independent existence, all having the same size and weight, each weighing about the one-thousandth part of an atom of hydrogen, or about 2.2×10^{-27} gramme and carrying an electrical charge of 2.2×10^{-19} coulomb.

The view is offered that these corpuscles are electricity, so that a negatively charged body is a body which has received an accession of mass, and a positively electrified body is a body which has experienced a temporary diminution in mass. The mass changes, it being, of course, excessively small. It seems to us that either Professor Thomson's language is here subject to accidental misinterpretation, or that the evidence for this proposition has not yet been adduced. If this view were correct, then negative electricity would be matter, a conclusion which the experimental evidence does not yet seem to warrant. All that does seem to be conclusive is that corpuscles, or atomic chips, are invariably accompanied by, or indissolubly linked with, a definite negative electrical charge. In other words, the corpuscles and the negative charge invariably go hand in hand; but it does not follow that they are identical. After pointing out that the presence of corpuscles in liquids or gases is capable of accounting for the phenomena of conduction in gases and electrolytes, the article goes on to indicate that the process of conduction in metals may be accounted for on the same supposition of free ions in their midst, which, wandering aimlessly at average speeds of 60 miles an hour in the substance of the metal, undergo very rapid changes of direction and velocity by reason of collisions with neighboring molecules. Under these lively but checkered conditions of existence, the free corpuscles do not ordinarily travel far in any direction. When, however, an e. m. f., or more strictly, an electromotive intensity or field of force is exerted in the metal, the corpuscles steadily drift up-stream along the lines of force and the amount of electricity conducted, for a given gradient of electrostatic field intensity, depends upon the number of free corpuscles and upon the freedom of their motion. The more violently they are jostled by the molecules and atoms which obstruct their path, the more slowly will be their drift in obedience to electric direction. Consequently the effect of rising temperature in increasing the obstructive jostling, and diminishing the conductivity, is satisfactorily accounted for on this theory.

It would really seem that in the future we may have a complete theory of electric conduction developed along the corpuscular lines here sketched. If, therefore, this theory is true, and if some metallurgical process could be discovered which would shake more chips off the atoms or copper, and thus present more free corpuscles for conduction, then we might expect copper to increase in conductivity in corresponding measure. The annealing of copper on this view is merely such a treatment as permits of molecular disengagement and therefore aids the wily corpuscle upon its wending way. It is quite conceivable that at some future time it shall be possible to obtain corpuscle-full copper of such good conductivity for heat and electricity that a wire of 100 circ. mils. should be the electrical equivalent of a million circ. mils. of modern copper, and at a corresponding economy in weight and price. In other words, it is conceivable that the present number of free corpucles per cubic centimeter of copper may be an incident, and not an inevitable necessity. According to the views which the article lays down, the reasons why copper conducts better than bismuth is that copper has more free corpuscles, and has no correspondingly greater obstructions in the way of their drifting under electric force.

A brief review is made upon the subject of mechanical inertia. Every corpuscle, and, in fact, every charged mass, possesses electromagnetic energy in virtue of its motion, and magnetic work has to be stored in the surrounding medium in order to accelerate a charged body in general, or a corpuscle in particular. The law of this action is precisely analogous to the law of mechanical inertia. Consequently, if this purely electromagnetic inertia were sufficiently great it would entirely account for and explain the ordinarily observed mechanical inertia of matter. Previous to the discovery of corpuscles, the electric charge capable of being attributed to a molecule of matter, say, hydrogen, was quite insufficient to account for its mechanical inertia. In other words, the amount of electromagnetic energy of motion stored in the neighboring ether was much too small, on the basis of the charge attributable to a molecule, to account for its mechanical inertia. If, however, a molecule of hydrogen contains, say, 1000 corpuscles, and each has a corpuscular charge, then the total quantity of electrical inertia might be sufficient to account for the observed mechanical inertia. Professor Thomson shows, however, that while this view is a fascinating one, there is as yet no direct substantiation for it. He has tried experiments with the object of testing the hypothesis, but these experiments, which are most ingenious, have hitherto yielded either negative or nugatory results. We therefore rest at present on the electromagnetic theory of inertia in matter with the verdict of possible and interesting, but not proven.

According to the theory laid down for the above-mentioned experiments, the impact of corpuscles upon matter must give rise to Röntgen rays; in other words, cathode rays, which are rapidly moving corpuscles, must give rise to the phenomena of Röntgen rays, when striking the walls of their containing Crookes' tube, and the Röntgen ray itself is a little solitary electromagnetic wave shed by the suddenly arrested corpuscular charge, which shed electromagnetic pellicle or integument, after the collision moves on in the ether with the velocity of light, as a solitary impulse, a periodic train of which would correspond to light. On this view the electromagnetic inertia energy of a corpuscle residing in its surrounding ether moves on as a Röntgen ray after the corpuscle itself is stopped by the glass wall of the tube, in a manner suggestive of the difference between the soul and body of the late respected John Brown.

Electricity and the New York Central Railroad Tunnel.

The Grand Jury of New York City has had under consideration the complaints laid before it as to the unhealthy condition of the tunnel through which the New York Central Railroad and its allied companies reach the New York City terminal. This tunnel is about two miles long, is divided by two interior brick walls, and is used daily by some 530 passenger trains, many of which are crowded with commuters. During the recent hot weather, when doors and windows had to be closed as usual to keep out the smoke and gases from the steam locomotives, the complaints were numerous and couched in strong language. Among other parts of its presentment made after hearing several witnesses, the following is of interest:

"From evidence adduced before it, the Grand Jury is convinced that in the present state of the art of electric application to mechanical ends the progress has been so general and uniform that everything requisite for an electrical installation in the tunnel and its approaches is as standard at the present time as steel rails or car wheels; that to install electrical traction in these tunnels and the approaches thereto everything required can be had without difficulty, delay, or great initial expense."

Electrical Engineers of the Day—VI.

C. J. REED.

Charles John Reed was born June 29, 1858, in Jasper County, Iowa. In 1877 he graduated from the Morris High School, and in 1881 from the University of Michigan. Though graduated from the classical course, he made all of his elective studies in physics, chemistry, mineralogy and mining, and received at his graduation, in addition to the regular diploma, the "special teacher's diploma" in physics and chemistry. For five years following his graduation he was Professor of Physical Sciences in the Township High School of Princeton, Ill., and in the Burlington (Iowa) High School. In 1886 he married Mary J. Crawford, of Burlington, and has three children.

In the summer of 1886 finding that the duties of the classroom were wearing on his nervous system, he moved to Idaho Springs, Colo., where, in company with Mr. M. T. Morrill, he engaged in the business of mineral surveying and minng, and in the installation of electric lighting plants in Georgetown, Idaho Springs, Golden, Denver, and other places. In this latter work he was also associated at first with Mr. Morrill and later with Mr. Paul Dyer and Mr. J. C. Hatzel, acting as the representatives of the Edison United Manufacturing Company for Colorado, Utah and New Mexico, with offices in Denver. At this time the electric lighting industry was in its infancy, and electric power plants had not come into existence, while the territory included, though extensive in area, was but thinly settled and unpromising. In addition to this circumstance, Mr. Reed could never make up his mind to be satisfied with commercial pursuits always longing for an opportunity to devote himself to physical and chemical research.

Thinking it would be a step in this direction, he accepted, in the fall of 1888, a position with the Jenney Electric Company, at Indianapolis, in charge of the incandescent lamp department, which gave the desired opportunity for study and investigation. Although the business was entirely new to him, and although little of practical value pertaining to the manufacture of incandescent lamps had been published at that time, within six months he had reduced the cost of lamps to less than half, and had at the same time improved the life and efficiency. One of his improvements was the introduction of methods of securing uniformity, which enabled him to produce lamps of an exact, predetermined voltage, temperature and candle-power. Shortly after these improvements were worked out, the Jenney Electric Company was absorbed by the Thomson-Houston Company, and the lamp department closed. From the fall of 1889 to July 1891, Mr. Reed was engaged in the surveying and examination of mining properties for Mr. T. A. Edison.

The study of electro-chemistry has been to Mr. Reed from youth one of intense fascination, and during the last ten years he has devoted his time almost exclusively to study and research in electro-chemistry and allied subjects. He has occasionally published papers on electro-chemical subjects, many of which have appeared in this journal. His publications have usually been prompted by a desire to correct what he conceived to be an erroneous doctrine or theory.

In 1894 Dr. W. Borchers published his sensational claims of having discovered a method of getting electrical energy directly from fuel by a galvanic process, which was hailed by Ostwald and other high authorities in Germany as the "prototype" of the galvanic cell that would revolutionize electrical industries. Mr. Reed promptly (*Electrical World*, Dec. 22, 1894) refuted this claim and showed that the electrical energy of the Borchers cell was derived from the oxidation of his copper electrode, a fact now generally admitted.

When in 1897 the Jacques "Carbon-consuming primary battery" was heralded as a discovery that would revolutionize industries by producing "electricity direct from coal," Mr. Reed at once pointed out the fallacy of these claims, showing, both by experimental demonstrations and theoretical considerations, that the electrical energy of this cell is of thermo-electric origin. He has also pointed out from time to time the fundamental fallacy of similar claims made for other "revolutionizing" carbon-consuming batteries, all of which have silently disappeared from public view. Mr. Reed has been frequently accused by his opponents of trying to discourage and belittle progress. He claims in reply that a pleasing error which inspires a false, sensational hope is not progress, but retrogression.

The dominant theory, to which Mr. Reed is now opposed, is that of electrolytic dissociation. This theory supposes that the constituents of an electrolyte in solution are in some manner dissociated or separated into ions having positive and negative electric charges; that these ions move in opposite directions through the body of the electrolyte under the directive influence of the electric current in quantities proportional to the current, and are deposited or set free at the electrodes by surrendering these electric charges to the electrodes.

Mr. Reed's belief is almost exactly the antithesis of this theory

According to him the molecules in a solution are neither dissociated in any way, nor electrically charged until an electric circuit has been completed through the electrolyte and two terminal electrodes; that the process of electrolytic separation of ions at the electrodes is one in which the ions in separating become charged instead of discharged; that the e. m. f. required to charge the pair of separating ions (that is, to produce the separation) is that which, multiplied by the coulombs, equals the chemical formation energy of the compound destroyed; that the current itself produces no directive motion or translation of matter, but merely overcomes chemical affinities; that all motion of the electrolyte and of the constituents of the electrolyte is due to diffusion (osmotic pressure), convection (mechanical currents), chemical affinity (in the formation of new molecules), and molecular rotation (caused by the formation of new molecules in a position which necessitates rotation through 180 degs.).

He rejects the theory of electrolytic dissociation on two grounds, namely, that it is not competent to account for all the facts to which it relates, and that such facts as it does explain may all be explained as well or better on the hypothesis substantially stated above. It does not, for example, account for the electrolytic conduction and decomposition of fused electrolytes, a class co-ordinate in general character with dissolved electrolytes.

Mr. Reed is a member of the American Institute of Electrical Engineers, to the *Transactions* of which he has made a number of contributions.

FIG. 1.—TYPICAL BOSTON ELEVATED STATION.—"CITY SQUARE."

Operating Features of the Boston Elevated.

BY FRANCIS H. SHEPARD.

IN its issue of June 15, the ELECTRICAL WORLD AND ENGINEER published an illustrated article on the Boston Elevated road, opened that week, and gave then a number of interesting details as to the road, system, etc. Now that the road has been in most successful operation for some weeks, the writer, who has been actively engaged upon the work and has watched its development, welcomes the opportunity to call attention to some of the features of operation.

Probably never in the history of transportation was a more difficult problem undertaken than the inauguration of the elevated service on the lines of the Boston Elevated Railway. As is well known, the transportation problem in Boston is most complex. The streets are narrow and crooked. The inner terminus for most of the traveling public is a restricted area and extremely congested. The congestion of the car service was considerably removed by the construction of the famous "Subway," built by the Rapid Transit Commissioners of the city of Boston, and leased to the railway company. This afforded temporary relief, but it was early found to be inadequate for Boston's growing needs.

The necessity for improved service was seen, and plans made were vigorously put into execution. The boldness of the conception of the present service can hardly be appreciated. On the 10.17 miles of track now operated the degrees of curvature number 3395, and the longest stretch of straight track is less than .28 mile. If the track were laid out with this amount of curvature from a common center, it would double on itself over nine times.

The ascending grades are as high as 5 per cent, or 264 ft. per mile, the descending grades as high as 422 ft. per mile, or 8 per cent. The problem was to secure rapid transit, and the greatest possibility of increased capacity for traffic. The present elevated route comprises 10.17 miles of track, of which 2.27 miles is underground in the Subway and the remainder on elevated structures at each end of the road. The subway portion will be supplemented shortly by the elevated structure of the Atlantic Avenue division, having 4.69 miles of track, which is nearing completion.

Surface cars were run on the subway tracks now occupied by the elevated lines since the Subway was opened. In order to make the track connections to the elevated structure, and to reconstruct the subway platforms for elevated trains, it was necessary to discontinue the surface cars on the tracks in the Subway. In order to discommode the public as little as possible, this change was made between Saturday night and Monday morning. On Saturday evening, June 8, at 8 o'clock, the last surface car was run over these tracks, and on Monday morning, June 10, at 5.30 o'clock, the elevated service was begun. A large force, over 1200 men, were busied during this time to make the change. In addition to perfecting the track, signals, platforms and equipment necessary to be placed in operation, the largest task in this limited time was to rearrange the operation of the surface lines and to provide for the changed conditions of traffic. Sixteen hundred surface cars are run on the Boston system. During Saturday night and Sunday, temporary schedules and lines were in operation. This would not have been possible during the middle of the week, as the street traffic would not permit the great number of cars on the streets.

The starting of the elevated service involved the changing of 51 lines of surface cars, and the inauguration of 23 transfer points. It also called for the provision of a new transfer system requiring the instruction of no less than 2500 conductors of the surface lines. Of the 850,000 daily passengers, fully 45 per cent were diverted from their accustomed routes of travel. When this service was undertaken not one of the trainmen had ever made a complete trip over the road, and few had ever seen train service, the whole equipment was entirely new, and last, but not least, few of the patrons had ever ridden on an elevated train. Under the extraordinary conditions surrounding this operation, every precaution to secure the greatest safety has been adopted. The cars are all provided with automatic trips, so that if a train is run past a stop signal, the air on the train is immediately thrown into "emergency." The guard rails are of 100 lbs. section, and are rigidly fastened. They are placed somewhat higher than the track rail so that the possibility of derailment is practically eliminated. The operation of the control is surrounded with perfect safeguards against improper or unsafe operation. If accident befalls the motorman, the current to the train is immediately cut off.

The strength and rigidity of the structure commends itself, and the excellence of the detail of track alignment and special work is

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Charles John Reed was born June 29, 1858, in Jasper County, Iowa. In 1877 he graduated from the Morris High School, and in 1881 from the University of Michigan. Though graduated from the classical course, he made all of his elective studies in physics, chemistry, mineralogy and mining, and received at his graduation, in addition to the regular diploma, the "special teacher's diploma" in physics and chemistry. For five years following his graduation he was Professor of Physical Sciences in the Township High School of Princeton, Ill., and in the Burlington (Iowa) High School. In 1886 he married Mary J. Crawford, of Burlington, and has three children.

In the summer of 1886 finding that the duties of the classroom were wearing on his nervous system, he moved to Idaho Springs, Colo., where, in company with Mr. M. T. Morrill, he engaged in the business of mineral surveying and minng, and in the installation of electric lighting plants in Georgetown, Idaho Springs, Golden, Denver, and other places. In this latter work he was also associated at first with Mr. Morrill and later with Mr. Paul Dyer and Mr. J. C. Hatzel, acting as the representatives of the Edison United Manufacturing Company for Colorado, Utah and New Mexico, with offices in Denver. At this time the electric lighting industry was in its infancy, and electric power plants had not come into existence, while the territory included, though extensive in area, was but thinly settled and unpromising. In addition to this circumstance, Mr. Reed could never make up his mind to be satisfied with commercial pursuits always longing for an opportunity to devote himself to physical and chemical research.

Thinking it would be a step in this direction, he accepted, in the fall of 1888, a position with the Jenney Electric Company, at Indianapolis, in charge of the incandescent lamp department, which gave the desired opportunity for study and investigation. Although the business was entirely new to him, and although little of practical value pertaining to the manufacture of incandescent lamps had been published at that time, within six months he had reduced the cost of lamps to less than half, and had at the same time improved the life and efficiency. One of his improvements was the introduction of methods of securing uniformity, which enabled him to produce lamps of an exact, predetermined voltage, temperature and candle-power. Shortly after these improvements were worked out, the Jenney Electric Company was absorbed by the Thomson-Houston Company, and the lamp department closed. From the fall of 1889 to July 1891, Mr. Reed was engaged in the surveying and examination of mining properties for Mr. T. A. Edison.

The study of electro-chemistry has been to Mr. Reed from youth one of intense fascination, and during the last ten years he has devoted his time almost exclusively to study and research in electrochemistry and allied subjects. He has occasionally published papers on electro-chemical subjects, many of which have appeared in this journal. His publications have usually been prompted by a desire to correct what he conceived to be an erroneous doctrine or theory.

In 1894 Dr. W. Borchers published his sensational claims of having discovered a method of getting electrical energy directly from fuel by a galvanic process, which was hailed by Ostwald and other high authorities in Germany as the "prototype" of the galvanic cell that would revolutionize electrical industries. Mr. Reed promptly (*Electrical World*, Dec. 22, 1894) refuted this claim and showed that the electrical energy of the Borchers cell was derived from the oxidation of his copper electrode, a fact now generally admitted.

When in 1897 the Jacques "Carbon-consuming primary battery" was heralded as a discovery that would revolutionize industries by producing "electricity direct from coal," Mr. Reed at once pointed out the fallacy of these claims, showing, both by experimental demonstrations and theoretical considerations, that the electrical energy of this cell is of thermo-electric origin. He has also pointed out from time to time the fundamental fallacy of similar claims made for other "revolutionizing" carbon-consuming batteries, all of which have silently disappeared from public view. Mr. Reed has been frequently accused by his opponents of trying to discourage and belittle progress. He claims in reply that a pleasing error which inspires a false, sensational hope is not progress, but retrogression.

The dominant theory, to which Mr. Reed is now opposed, is that of electrolytic dissociation. This theory supposes that the constituents of an electrolyte in solution are in some manner dissociated or separated into ions having positive and negative electric charges; that these ions move in opposite directions through the body of the electrolyte under the directive influence of the electric current in quantities proportional to the current, and are deposited or set free at the electrodes by surrendering these electric charges to the electrodes.

Mr. Reed's belief is almost exactly the antithesis of this theory

According to him the molecules in a solution are neither dissociated in any way, nor electrically charged until an electric circuit has been completed through the electrolyte and two terminal electrodes; that the process of electrolytic separation of ions at the electrodes is one in which the ions in separating become charged instead of discharged; that the e. m. f. required to charge the pair of separating ions (that is, to produce the separation) is that which, multiplied by the coulombs, equals the chemical formation energy of the compound destroyed; that the current itself produces no directive motion or translation of matter, but merely overcomes chemical affinities; that all motion of the electrolyte and of the constituents of the electrolyte is due to diffusion (osmotic pressure), convection (mechanical currents), chemical affinity (in the formation of new molecules), and molecular rotation (caused by the formation of new molecules in a position which necessitates rotation through 180 degs.).

He rejects the theory of electrolytic dissociation on two grounds, namely, that it is not competent to account for all the facts to which it relates, and that such facts as it does explain may all be explained as well or better on the hypothesis substantially stated above. It does not, for example, account for the electrolytic conduction and decomposition of fused electrolytes, a class co-ordinate in general character with dissolved electrolytes.

Mr. Reed is a member of the American Institute of Electrical Engineers, to the *Transactions* of which he has made a number of contributions.

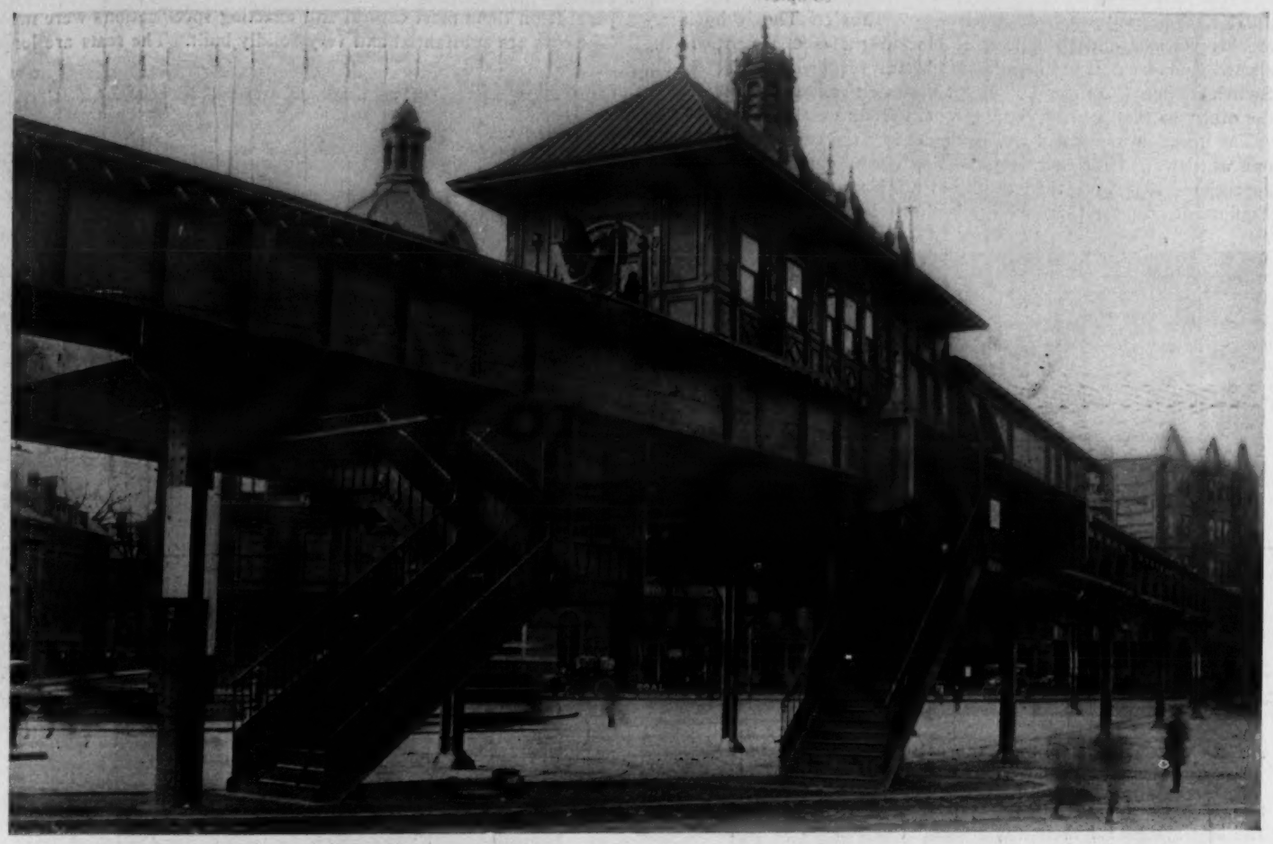


FIG. 1.—TYPICAL BOSTON ELEVATED STATION.—"CITY SQUARE."

Operating Features of the Boston Elevated.

BY FRANCIS H. SHEPARD.

IN its issue of June 15, the ELECTRICAL WORLD AND ENGINEER published an illustrated article on the Boston Elevated road, opened that week, and gave then a number of interesting details as to the road, system, etc. Now that the road has been in most successful operation for some weeks, the writer, who has been actively engaged upon the work and has watched its development, welcomes the opportunity to call attention to some of the features of operation.

Probably never in the history of transportation was a more difficult problem undertaken than the inauguration of the elevated service on the lines of the Boston Elevated Railway. As is well known, the transportation problem in Boston is most complex. The streets are narrow and crooked. The inner terminus for most of the traveling public is a restricted area and extremely congested. The congestion of the car service was considerably removed by the construction of the famous "Subway," built by the Rapid Transit Commissioners of the city of Boston, and leased to the railway company. This afforded temporary relief, but it was early found to be inadequate for Boston's growing needs.

The necessity for improved service was seen, and plans made were vigorously put into execution. The boldness of the conception of the present service can hardly be appreciated. On the 10.17 miles of track now operated the degrees of curvature number 3395, and the longest stretch of straight track is less than .28 mile. If the track were laid out with this amount of curvature from a common center, it would double on itself over nine times.

The ascending grades are as high as 5 per cent, or 264 ft. per mile, the descending grades as high as 422 ft. per mile, or 8 per cent. The problem was to secure rapid transit, and the greatest possibility of increased capacity for traffic. The present elevated route comprises 10.17 miles of track, of which 2.27 miles is underground in the Subway and the remainder on elevated structures at each end of the road. The subway portion will be supplemented shortly by the elevated structure of the Atlantic Avenue division, having 4.69 miles of track, which is nearing completion.

Surface cars were run on the subway tracks now occupied by the elevated lines since the Subway was opened. In order to make the track connections to the elevated structure, and to reconstruct the subway platforms for elevated trains, it was necessary to discontinue the surface cars on the tracks in the Subway. In order to discommode the public as little as possible, this change was made between Saturday night and Monday morning. On Saturday evening, June 8, at 8 o'clock, the last surface car was run over these tracks, and on Monday morning, June 10, at 5.30 o'clock, the elevated service was begun. A large force, over 1200 men, were busied during this time to make the change. In addition to perfecting the track, signals, platforms and equipment necessary to be placed in operation, the largest task in this limited time was to rearrange the operation of the surface lines and to provide for the changed conditions of traffic. Sixteen hundred surface cars are run on the Boston system. During Saturday night and Sunday, temporary schedules and lines were in operation. This would not have been possible during the middle of the week, as the street traffic would not permit the great number of cars on the streets.

The starting of the elevated service involved the changing of 51 lines of surface cars, and the inauguration of 23 transfer points. It also called for the provision of a new transfer system requiring the instruction of no less than 2500 conductors of the surface lines. Of the 850,000 daily passengers, fully 45 per cent were diverted from their accustomed routes of travel. When this service was undertaken not one of the trainmen had ever made a complete trip over the road, and few had ever seen train service, the whole equipment was entirely new, and last, but not least, few of the patrons had ever ridden on an elevated train. Under the extraordinary conditions surrounding this operation, every precaution to secure the greatest safety has been adopted. The cars are all provided with automatic trips, so that if a train is run past a stop signal, the air on the train is immediately thrown into "emergency." The guard rails are of 100 lbs. section, and are rigidly fastened. They are placed somewhat higher than the track rail so that the possibility of derailment is practically eliminated. The operation of the control is surrounded with perfect safeguards against improper or unsafe operation. If accident befalls the motorman, the current to the train is immediately cut off.

The strength and rigidity of the structure commends itself, and the excellence of the detail of track alignment and special work is

notable. The movement of trains is governed completely by interlocking stations and by automatic block signals. They are of the electro-pneumatic type manufactured and installed by the Union Switch & Signal Company. One of the track rails is insulated from the other, so that a track circuit signal system can be used.

The question of control and equipment of the trains was probably one which called for the most exacting consideration. It was early appreciated that more than the usual motive power should be used. Equipment on more than one car in the train, the "multiple unit system, was considered imperative. In order to determine the safest and best system for their use, it was decided to invite the installation of the different equipments on test trains to be run over the most difficult portion of their road—the Subway. The tests and investigation made were without doubt the most complete and elaborate ever undertaken in competition for electrical apparatus. The contract was awarded the Sprague Electric Company.

FIG. 2.—UNDER THE CAR, SHOWING GRIDS, AIR COMPRESSOR AND MOTOR TRUCK.

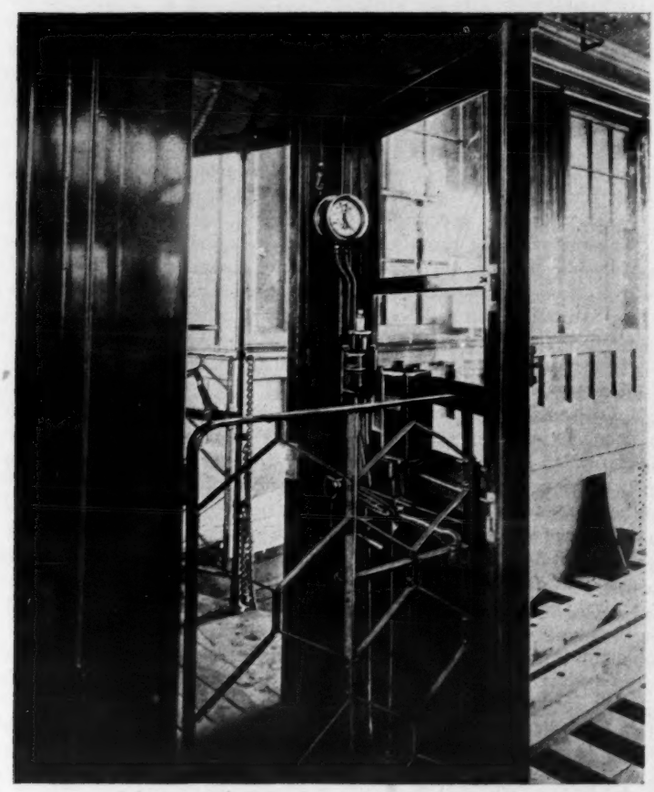


FIG. 3.—AIR BRAKE AND CONTROL APPARATUS IN CAB.

For the construction of the cars and the installation of all apparatus on them most careful and exacting specifications were made. The cars are substantial and very solidly built. The seats are longitudinal and center doors are used. The platforms are longer than customary. The familiar "Sprague" folding cab is used for the motorman and operating apparatus. It permits the gates on each side of the platform to be of the same size and gives free access across the platform. The cars seat 48 passengers; 80 more can comfortably stand up. The trucks were built by the Baldwin Locomotive Works. Both motor and trailer trucks are solidly built and of heavy construction. The motor axles are 6½ inches diameter at center, with 7½-inch wheel fits. The wheel base of the motor truck is 6 ft., and the wheels 33 inches in diameter. The wheel base of the trailer truck is 5 ft. and the wheels 30 inches in diameter. The wheels are steel tired, and the gears solid and pressed on the axles. The side bar type of motor suspension is used. Automatic couplers of the Van Dorn type of extra heavy construction are used.

FIG. 4.—STANDARD CAR COMPLETE.

Two Westinghouse motors, type "50 C," of 150-hp capacity each, are used. They are rights and lefts, so that the commutators are on the same side to permit of ready inspection. The air brake system is that of the Christensen Engineering Company. The motor-driven compressor has a capacity of 20 cubic feet per minute to a pressure

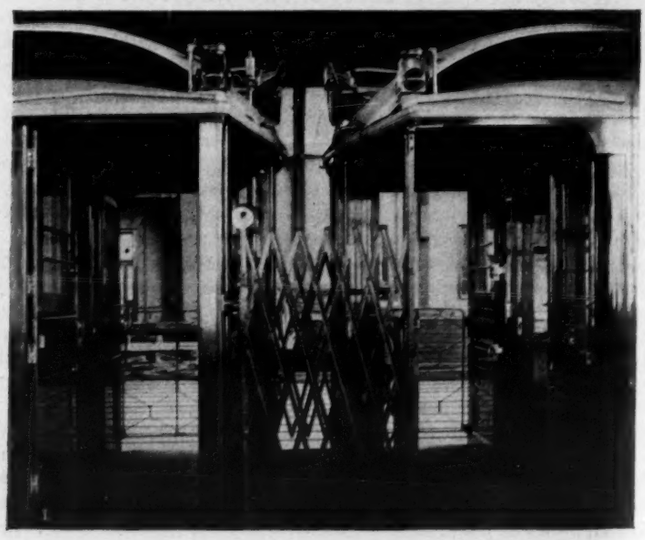


FIG. 5.—CAR PLATFORMS IN MIDDLE OF TRAIN.

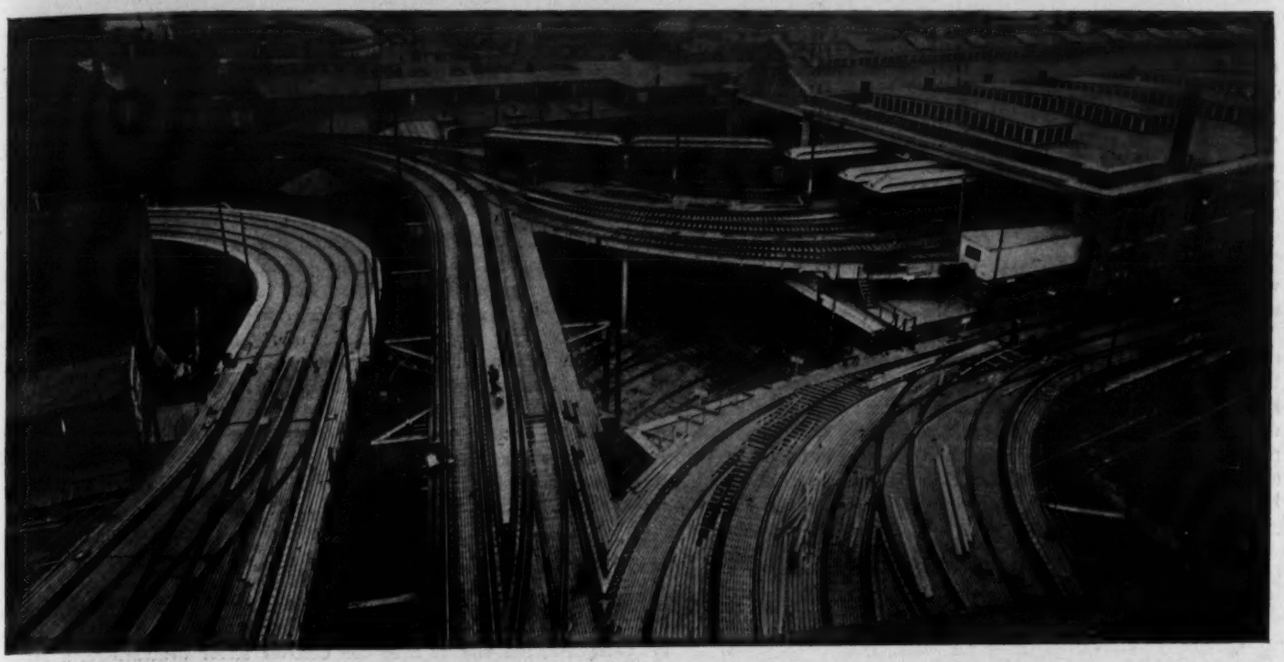


FIG. 6.—SULLIVAN SQUARE TERMINAL YARD AND SHOPS.

of 90 lbs. The engineer's valves are of the Christensen type with excess pressure adjustment. The tripples are also their standard type. The governors are of the equalizing type, and control all of the compressors in a train. The cars are heated electrically with heaters

FIG. 7.—TRAINS ASCENDING INCLINE FROM SUBWAY TO NORTH STATION.

furnished by the Gold Car Heating Company. There are three degrees of heat, respectively taking 7, 14 and 21 amperes per car.

The cars are fitted with combination electric colored markers, which are wired in the car lighting circuit. There are 21 inside lights and 4 platform lights. The lights are uniformly distributed, and the cars are exceptionally well lighted.

The multiple unit control equipment is the Sprague standard type. The working apparatus is located in a compartment under a portion of the seat at one corner of the car. This compartment is open through the bottom of the car. Complete isolation of working currents from the inside of cars is thereby secured with all the advantages of ready and efficient inspection which on the lifting of the seat such location insures. The protection and isolation of the car wiring is a matter to which especial attention has been given. It was appreciated that the current value of any local short circuit would be in excess of any reached in any service existing elsewhere, and that any such short circuit might be hazardous. The current is collected from four contact shoes carried on long wooden shoe beams on the trucks. The main car wiring is led to each shoe through a detachable shoe fuse. The shoe fuse clears any accidental ground either on the car or by a contact shoe. From the junction of the contact shoe leads, the main wiring extends to a protected compartment in the hood at one end of the car, where the taps are made for lights, heat, air and control apparatus, to the main switch, then back to an enclosed main fuse of the "Noark" type, located under the car; then to the control apparatus and motors.

All of the truck, car and motor wiring is of special high grade 3000-volt insulation. It is removed from all vibration as far as possible, and enclosed for mechanical protection. The resistances are the well-known "Sprague" cast loop type, and are of sufficient capacity to permit of continuous operation on them. All the wires are laid up in standard cables and fitted with terminal lugs, which secures wiring of the simplest and most efficient kind.

Current for the elevated service is delivered from the stations as follows:

Stations.	Maximum Capacity Amperes.	Circular Mils Elevated Feeders.	Feet to Elevated Structure.
Central	40,350	8,000,000	800
East Cambridge	7,650	6,000,000	5,000
Charlestown	4,350	4,000,000	1,000
Lincoln	21,150	20,000,000	200

Reference to this table will show the possibility of current flow which would follow a short circuit on the elevated lines. By reason

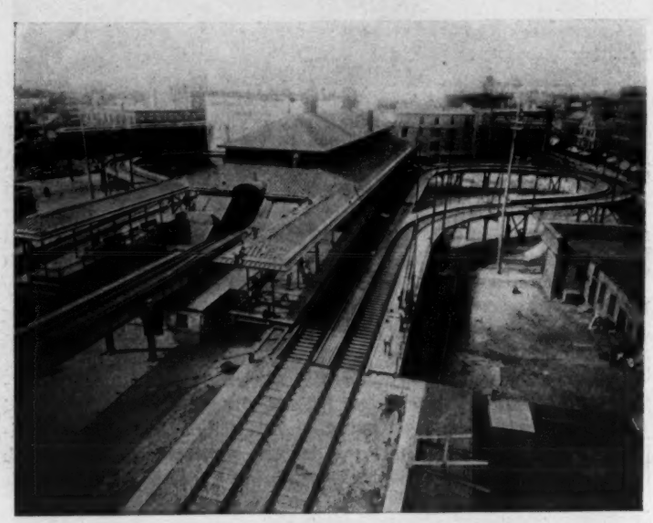


FIG. 8.—DUDLEY STREET TERMINAL, SHOWING SURFACE LINE LOOP.

of the grades and alignment of the system and the high speed and frequent service maintained, the fluctuations of load are severe. A-

the stations feed both elevated and surface lines, the fluctuations due to the elevated service are taken care of without difficulty. Observations as far as made indicate that the current demand for a section of the elevated line 1½ miles long having in operation 9 trains, varies from 500 amperes to 6000 amperes. Even with such extraordinary demands for current, the minimum voltage at the contact rail is 500 volts. This is because of the large section of feeders and the proximity of the power stations. The feeders used are of 2,000,000 circ. mils. section, and are run in conduit to the structure where bare tinned copper cables mounted on special glass insulators are used. They are covered by a cable box, the top of which forms a convenient walk on the structure. The several sections of the contact rail are tied together by enclosed fuses of 2400 amperes capacity.

Some of the elevated and the surface line sections are fed from two or more separate stations. This ties the stations together and distributes heavy pulls among the different stations. To further assist in this distribution of "pulls," the generators are given a drooping characteristic. Thus when an extremely heavy pull occurs in close proximity to one station, its voltage falls and the other stations assist in carrying it. In addition, if any station by reason of locally heavy traffic is overloaded, a portion of its load is shifted to other

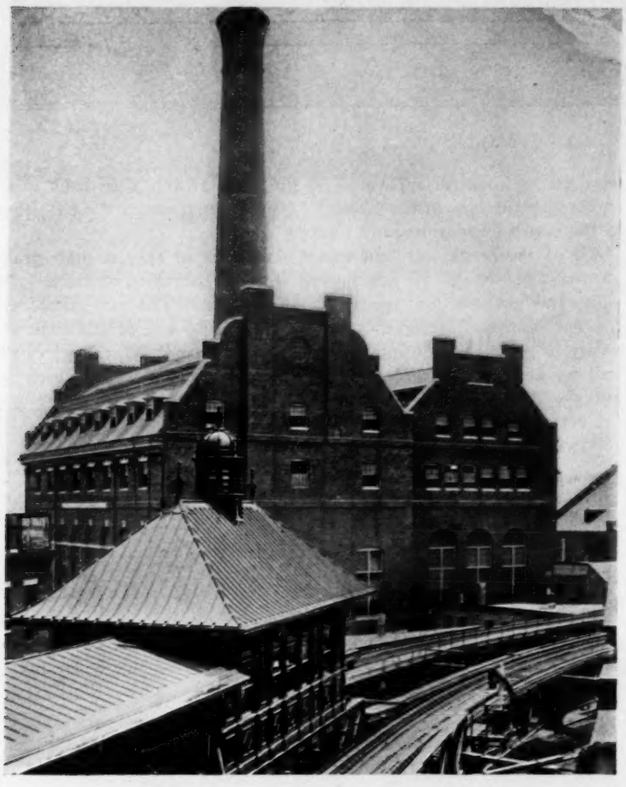


FIG. 9.—LINCOLN POWER STATION.

stations by voltage reduction at the generators by the field rheostats.

The feeder system is very carefully laid out, so that any section may be cut out without interfering with the operation of the rest of the system. In order to prevent the contact shoes bridging from a live section to one in trouble, a rail of suitable length fed through permanent resistance is inserted between the two sections. Specially designed "protected" rail bonds are in use for feeder taps to the contact rail. The track is well bonded to the structure to provide an efficient return circuit.

Lincoln Power Station is the one most recently built. It is thoroughly modern in every respect. Vertical engines direct connected to generators of 2700 kilowatts normal capacity are used. The ultimate rated capacity of this station will be 18,900 kilowatts, with ability to carry for one hour 28,000 kilowatts, and for brief periods 38,000 kilowatts.

During acceleration each car takes a maximum of 550 amperes, and an acceleration of 1.8 miles per hour per second is obtained. The maximum speed reached between stations is 46 miles per hour. The acceleration is uniform and the track is of such excellent construction that it is most difficult to realize the high speeds that are attained.

As near as has been determined the current consumption per car mile is 4.5 kilowatt-hours. The present mileage is 15,000 car-miles per day. The grades encountered and the high speeds run reflect strikingly in the extreme wear of the brake shoes and wheels. The shoes first used were completely worn out after 200 miles of service. Special shoes are now used and longer service is secured. This also means exceptional wear on the wheel tires.

The present elevated service runs from Sullivan Square, Charlestown, through the Subway to Dudley Street, Roxbury. At Sullivan Square, the main shops and a large terminal transfer station and office building are located. This terminal building and train shed for surface and elevated cars is one of the largest and most commodious in existence. The train shed is 200 ft. long, and is spanned by a single arched roof of 175 ft. span. In the building on the first floor, are large and well appointed waiting rooms, and on the second floor are the elevated division offices. At this point free transfers to and from 16 lines of surface cars running through Arlington, Somerville, Malden, Medford and Everett are given. The traffic through this station is heavy, as many as 125,000 passengers per day, and for an hour 24,000 passengers having been handled.

Leaving Sullivan Square, the run is made around a loop of 112 ft. radius, then following Main Street and its numerous curves to City Square station, also in Charlestown. This station is an intertrack station. Transfers are made here to and from 18 lines of surface cars running to the numerous towns east of Charlestown and through Lynn, Swampscott, Revere and Chelsea. Leaving City Square, the run is over the Charles River drawbridge, a massive double-deck structure, thence past Causeway Street Junction with the Atlantic Avenue division, around the curves to the North Station. This station is quite an important one as transfers are issued to and from 37 lines of surface cars radiating over practically the whole system. By reason of its proximity to the terminal station of the northern and western steam railroads a large volume of traffic originates here.

Leaving Union Station, a descent down an incline on a 5 per cent grade is made into the Subway. At the foot of the grade around a reverse curve is Haymarket Square station. Transfers may be secured here to and from no less than 38 surface lines which radiate over practically the whole system. Leaving Haymarket Square, the run is made around some rather severe curves and up a varying grade, which is at one point in combination with a sharp curve equal to 5.5 per cent, and Scollay Square station is reached. This is one of the most important inner terminals, and a good deal of traffic originates here. This station is the terminus for the Boston lines of the Lynn & Boston Railroad, and also for 10 lines of surface cars operated by the Boston Elevated Railway Company.

The run to Park Street, another important subway terminus, is made around numerous curves and up grades, stopping at the station on 3 per cent descending grade. Free transfer is made here to and from 35 lines of surface cars radiating from Neponset on the southeast to Arlington, Cambridge and Somerville on the north. This station is a combined surface and elevated station and an exceedingly busy one. Leaving Park Street, a sharp reverse curve is met and passing around several other curves and down a varying grade as high as 2 per cent, Boylston Street station is reached. Free transfer is made here to the same lines as at Park Street.

Leaving Boylston Street, the run is most tortuous. Descent is made down an 8 per cent grade around a sharp reverse curve without connecting tangent around other curves and over a changing grade, ascending 4.5 per cent, descending 3 per cent, ascending 2.9 per cent, descending 3 per cent, ascending 5 per cent, then finally descending 1.5 per cent to Pleasant Street station. This station is located just outside the Subway, at the foot of the incline to the elevated structure. Transfers are issued to and from nine lines of surface cars running through Jamaica Plain, Brookline and South Boston.

Leaving Pleasant Street, ascent is made of a grade of 5 per cent around a long curve over the Boston & Albany tracks, past Castle Street Junction, then by Washington Street to Dover Street station. This is a busy transfer station, and transfers are issued to 13 lines running through Cambridge, Milton, Neponset and South Boston. From Dover Street, a continuous run is made, few curves being met, on a level track to Northampton Street. Transfers are exchanged here with 13 surface lines running through Cambridge, Newton, Forest Hills and South Boston. From Northampton Street, the run is made to Dudley Street, around several curves and varying grades, and around a loop of 105 ft. radius into Dudley Street terminal. Twenty-four lines of surface cars terminate here and ex-

change passengers with the elevated. These lines radiate over practically the entire system on the south. The traffic here is very heavy and probably equals that at the Sullivan Square terminal. The average day's traffic through each of these terminal stations is approximately 80,000 passengers.

Perusal of the foregoing data will indicate the extreme density of traffic over the whole line, and how imperative the appointments for the safe and rapid handling of the service had to be. Not the least important are the platform arrangements necessary to care for such traffic. At the terminals and also at the busy stations in the Subway, free access on the same level is given between elevated and surface cars. At other points, ticket transfers are issued to and from the street. The traffic has so far exceeded all expectations that both the platform gates and center doors are used at all stations. On each platform opposite car entrances is painted, "Enter here," to ensure the prompt loading of passengers.

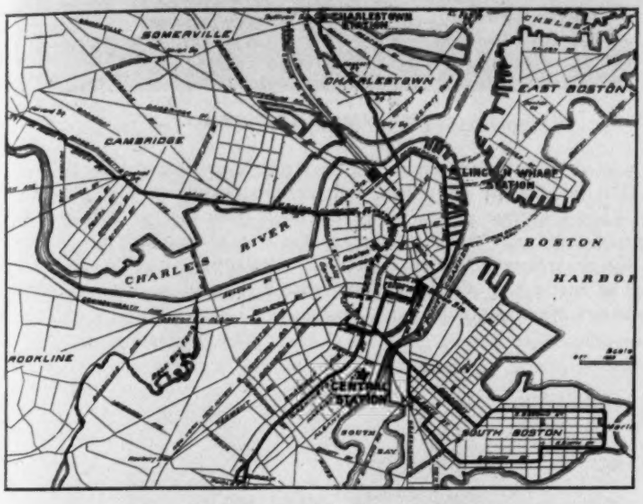


FIG. 10.—MAP OF LINE SHOWING POWER PLANTS.

By printed notices in the cars and signs at stations, passengers are requested to leave the cars at the center door and enter at the gates. At each station the trains are "rung off" by a large gong. The gates are then shut immediately, and the station stops are thus reduced to a minimum. There has been a most remarkable development in the alacrity which the patrons of the road have attained in entering and leaving trains. The positive manner in which the gates are closed on signal has much to do with this. The smoothness of operation and the speed of the trains have served to make the service very popular.

Additional contracts for more equipment have already been made. Plans are being made for the extension of the elevated structure and for the construction of an additional subway. The near future will doubtless see no less than 50 miles of elevated track and 600 cars in operation.

Great credit is due the management for the energetic manner in which the undertaking has been carried along. The executive committee is comprised of Mr. William A. Gaston, chairman; General William A. Bancroft, president, and Messrs. Robert Winsor and J. M. Prendergast, directors. The working out of this great problem in passenger transportation has devolved upon Mr. Charles S. Sergeant, vice-president, who has long been known as an able railway manager of the advanced type, and upon Mr. Paul Winsor, his assistant, who is also directly responsible for the workings of the technical side of this undertaking.

In the operating department Mr. S. S. Neff is superintendent, assisted by Mr. Eugene McKernan, trainmaster. The careful schooling they have given the trainmen is reflected in the excellent service. The structure, stations and track were laid out and constructed under the supervision of Mr. George A. Kimball, chief engineer of the elevated lines, and are noteworthy as the most elaborate known in the art.

Mention should also be made of Mr. A. D. Campbell, superintendent of construction of the Sprague Company, for the excellence of the installation on the cars. Since the commencement of the service there has not been an accident of the slightest nature. This result, in view of the difficulties to be met, is most remarkable. The equipment of this road is conceded to be the most advanced in all respects, and its successful operation will certainly continue to be followed with interest by those engaged in transportation work.

The Telephone in Railway Service.

The Delaware, Lackawanna & Western Railroad Company is building a copper metallic circuit over its main line and branches, to be used, as already noted in these columns, in the dispatching of trains and transacting other railroad business by telephone. The system is already in practical operation on some of the branch lines, and as the construction work on the various sections of the road is finished the telephone is immediately put into service. It is expected that the entire railroad system will be equipped telephonically within six months.

The railroad company has become a licensee of the American (Bell) Telephone & Telegraph Company, and is permitted by the latter to connect its wires with the telephone exchanges at the principal points where private branch exchanges are maintained by the railroad, thus enabling the railroad people to reach any subscriber in the places so connected. In return for this privilege the railroad company agrees to use Bell apparatus exclusively, which it gets at a very low rental. In the construction of the new line the Bell standard is followed, No. 12 copper wire (170 lbs. per mile) being used.

The dispatching of trains by telephone has been criticized on the ground that no record is made of orders or messages. The fallacy of this objection is obvious when it is remembered that telephone messages in railroad work are required to be written down just as telegraph messages are, hence there is really no more liability to error in a telephone message than there is in a telegram. The system of sending train orders by telephone, as developed by the Delaware, Lackawanna & Western Railroad officials, is simple in the extreme, and rapid as well. For each class of order a printed form is provided, having blank spaces to be filled in by telephone. The printed portions of the message being invariable as to phraseology, do not require to be transmitted over the telephone, only the words or figures necessary to fill in the blank spaces to complete the order. The company, we understand, uses over 40 different forms in its telephone service.

In order to secure a permanent record for reference the company is having some interesting experiments conducted. It is proposed to combine the telephone and the phonograph for this purpose. Mr. Thomas A. Edison now has the experimental work in hand, and assures the railroad people that he will produce for them an instrument that will meet their requirements. Mr. Edison proposes to use a phonograph of special construction for this work. It will have a cylinder of such dimensions as to make a record of orders given during 24 hours. These phonographs will be placed in the various dispatchers' offices, and will make records of all orders issued by the dispatchers and the same orders as repeated back. In case of an error the record will enable the dispatcher to determine at once who made the error—the sender or receiver of the message. In this respect the telephone-phonograph system will prove superior to the telegraph, since in a telegram it is impossible to determine whether the sender or the receiver is at fault. The actual mechanical details of the phonograph combination cannot yet be learned, as the work is still in Mr. Edison's hands.

Apart from the use of the telephone in the dispatching of trains, it affords an equally, or even more important service to a railroad. It enables every official to personally communicate with every other official on the line of the road in much less time than by telegraph, the two telegraph operators being entirely eliminated in each communication—the advantage of this feature was exemplified during the recent strike in the coal regions controlled by the Delaware, Lackawanna & Western Railroad Company. Conferences were held by telephone between the president at his summer home, the general superintendent at Buffalo or elsewhere, and the superintendent of the mining district. At these conferences, the situation was discussed and plans were laid down as readily and effectively as if all the officials had conducted their deliberations together in one office. Such uses of the telephone enabled the officials to be everywhere on the line of the road at the same time, and this without moving from their desks.

The private car of the general superintendent of the road is furnished with a telephone outfit and wherever that official goes he keeps in personal touch with affairs all along the line by plugging in

his telephone at sidings. The private car of the president is being similarly equipped.

The introduction of the telephone on the Delaware, Lackawanna & Western Railroad is due largely to the enterprise and far-sightedness of Mr. L. B. Foley, superintendent of telegraph of that road. Mr. Foley years ago perceived the possibilities of the telephone in railroad service, and has never ceased to advocate its use, although he found much conservatism to break down. In this connection it may be of interest to note that this subject was well covered in a paper read by Mr. F. P. Valentine at the recent convention in Buffalo of the Association of Railway Telegraph Superintendents, an abstract of which paper appeared in these columns June 29, 1901.

The Delany Rapid Telegraph System.

The Delany rapid telegraph system, which has been undergoing a long process of improvement at the hands of its inventor, P. B. Delany, of Orange, N. J., is now being exhibited at the Pan-American Exposition. Mr. Delany some time ago perfected apparatus for the perforating of tape and sending of messages to be received and read in the ordinary way by a Morse operator. The greatest interest

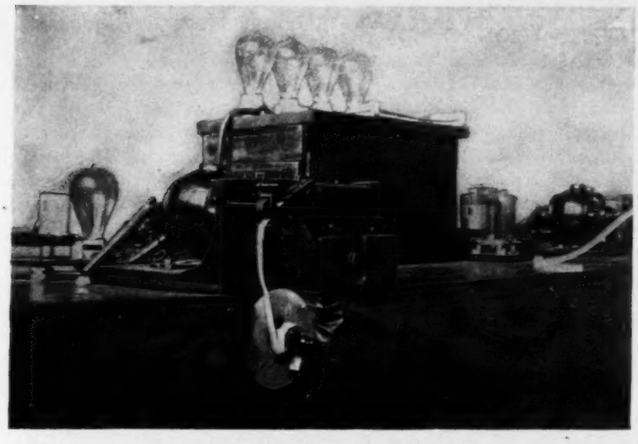


FIG. 1.—CHEMICAL RECEIVER.

centers, however, about the recently completed very rapid system which uses a chemical receiver. The chemical receiver marks a radical change in rapid telegraph methods. It is based on a principle conceived some time ago by Mr. Delany, but not put in a shape to make it commercially available until the invention of a punch which could be worked by an ordinary Morse operator without previous practice. Such a punch has been perfected and completes a system of rapid telegraphy which has overcome many of the obstacles that have stood in the way heretofore.

One of the greatest obstacles to rapid sending by the Morse code has been the "tailing" or drawing out of the dots on account of the capacity or condenser effect of the line. If the line is long it acts as a condenser to discharge current through the receiving instrument for an interval after the current has been cut off at the sending instrument. Mr. Delany has ingeniously made this condenser effect or tailing help instead of hinder his work. In fact, a certain amount of capacity is necessary in the line to have the receiver work successfully, and if the line is not long enough to give this a condenser must be used.

In the Delany system a tape is first perforated by an operator working as he would with an ordinary Morse key. The tapes so prepared by the operators in an office are then put into a sending instrument to be run through at the rate of 100 to 8000 words per minute, according to the length of the line. The message is received on a tape by a chemical receiver, and this tape is given to the various tape readers in the receiving office to decipher.

The chemical receiver, which is shown in Fig. 1, and is driven by a small motor, makes use of a receiving tape which has been dipped into prussiate of potash, an electrolyte which will make a blue mark when an iron cathode is brought against the tape. The damp tape is

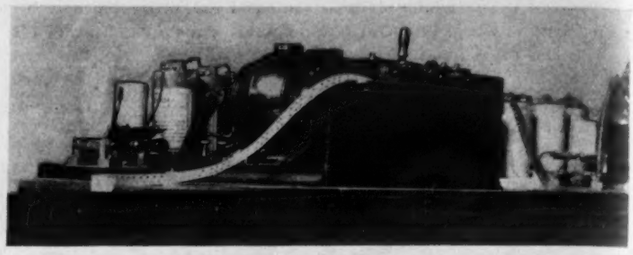


FIG. 2.—SENDING INSTRUMENT.

passed over rollers under three electrodes arranged side by side. The middle one is of iron, and the two outside ones of platinum. When a current passes in one direction from the two outside electrodes through the moist tape to the iron electrode in the middle, the electrolytic action causes the iron electrode to make a blue mark. Current in the other direction leaves no record, as the outer electrodes are of platinum.

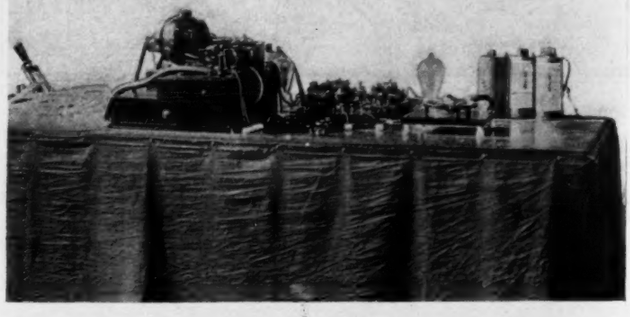
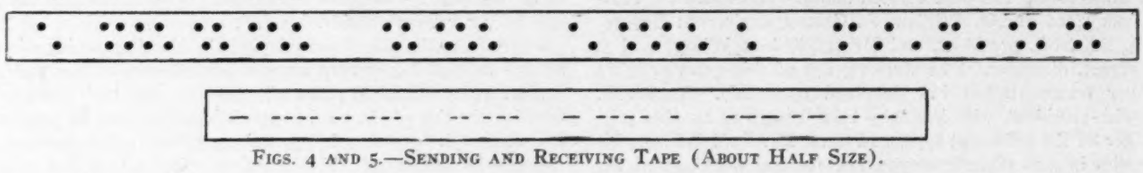
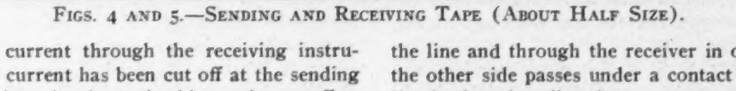


FIG. 3.—PUNCHING INSTRUMENT.

To understand the working of the receiver it is now necessary to go into the working of the sending tape and instrument. The sending tape is perforated, as shown in Fig. 4, and is run through a motor-driven sender, as shown in Fig. 2. On the tape there is a punch mark on the upper half (as shown in Fig. 2), at the beginning of each dot or dash, and a punch mark on the lower half at the close of each dot or dash. The horizontal distance between punch marks represents the relative length of dots, dashes or spaces. As this tape goes through the sending machine in Fig. 2 it passes under two contact fingers, one of which is over one row of holes and the other over the other row of holes. When a hole on one side of the tape passes under the contact finger on its side, a current impulse is sent over the line and through the receiver in one direction. When a hole on the other side passes under a contact finger, current is sent over the line in the other direction.





FIGS. 4 AND 5.—SENDING AND RECEIVING TAPE (ABOUT HALF SIZE).

When a dot or dash is to be made, current is sent over the line in such a direction by the punch mark at its beginning, that the iron electrode on the receiving tape leaves a blue mark on the tape. The battery is, of course, immediately cut off as the punch mark passes from under the contact finger, but the capacity of the line causes it to discharge through the receiving tape and continue the blue mark until current is sent in a reverse direction by the punch mark at the close. The instant the current is reversed the electrolytic record of the dot or dash is stopped. All difficulty from tailing due to the capacity of the line is thus avoided and the capacity is made a help instead of a detriment.

The rate of transmission possible with this arrangement is almost inconceivably rapid, and telegraphers who watch the sending of a message by this system at the Pan-American can hardly realize that a telegram has been sent in the second or two which it takes to run through a lengthy message.

In a system of this kind it is extremely desirable that the tape be perforated by a Morse operator by methods he is accustomed to. A punching machine by which the peculiar kind of tape used in the sender can be punched by the ordinary operation of a Morse key has recently been perfected by Mr. Delany. It operates one punch upon the depression of a key and the other punch upon the release of the key. This punch machine as exhibited at the Pan-American is shown in Fig. 3. Figs. 4 and 5 are reproduced from samples of the sending and receiving tape on which the marks are made by electrolysis.

The Josse Waste Heat Engine.

On several occasions we have referred to a type of engine developed in Germany by Professor E. Josse, of the Royal Technical High School of Berlin-Charlottenberg, for which great claims in economy have been made. From a pamphlet recently published by Professor Josse we are enabled to give some details of the engine. The system consists briefly in utilizing part of the heat in the condensing water of the ordinary condensing steam engine to evaporate sulphur dioxide (SO_2), the vapor being used to drive another engine.

Fig. 1 gives a diagrammatic representation of the system. *A* is the ordinary steam engine and *B* the steam surface condenser into which the steam exhausts, which condenser also serves as a boiler for evaporating the sulphur dioxide. *C* is the SO_2 engine and *D* its condenser, from which the sulphurous acid is drawn from the pump *E* and returned to the steam condenser *B*.

A vacuum of 24 inches in the cylinder of the steam engine corresponds to an exhaust temperature of 140 degs., and at this temperature sulphur dioxide vapor has a pressure of 156.5 lbs. per square inch. absolute, and at 60 degs., or the temperature of the condenser cooling water, it has a pressure of 40.8 lbs. per square inch absolute. Consequently, under these conditions as to temperature the sulphur dioxide may be used for developing power in the cylinder in expanding from 156.5 lbs. to 40.8 lbs. per square inch.

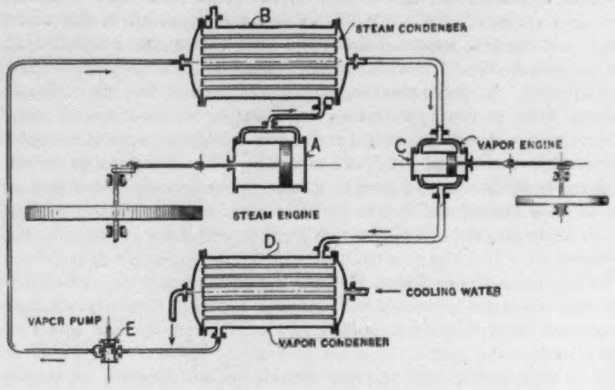


FIG. 1.

The mechanical laboratory of the Technical High School of Berlin-Charlottenberg possesses a 150-hp triple-expansion engine, used for electric lighting and experimental purposes, and the Josse system was experimented with in connection with this engine. The engine is supplied with a second crank, with rod guides, etc., adapted for attaching compressors or pump cylinders for experimental purposes, and an SO_2 engine was connected with this crank. The dimensions of the steam engine are 10⅝ inches by 16 15-16 inches by 26 9-16 inches, with 19 11-16-inch stroke, the normal speed being 150 r. p. m. The vapor cylinder has a diameter of 16 15-16 inches, and the same stroke as the steam piston. The vapor cylinder was sup-

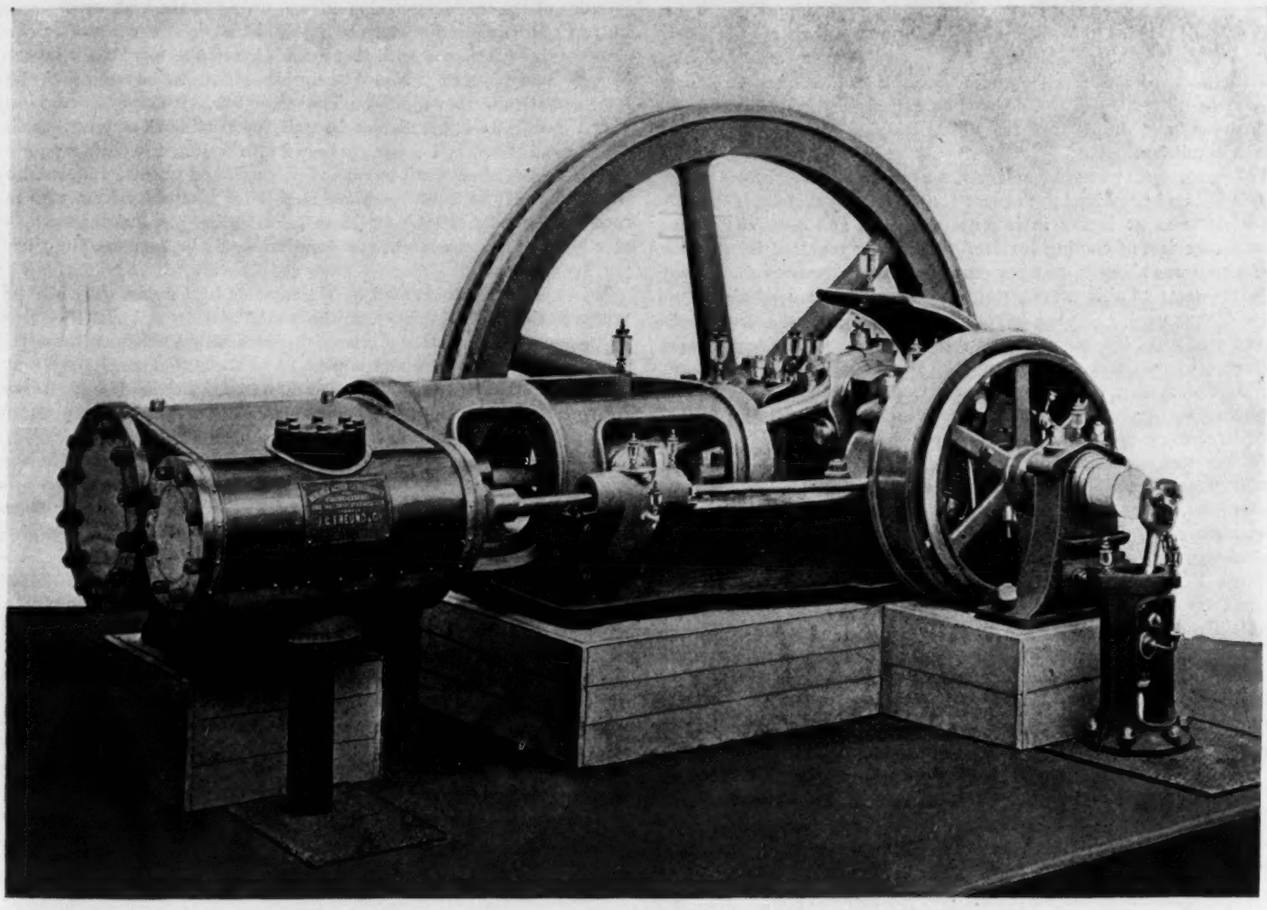


FIG. 2.—WASTE HEAT ENGINE, BERLIN ELECTRIC LIGHT STATION.

plied with poppet valves, a departure from the usual design of these valves having been made in order to obviate any possibility of leakage at the stuffing boxes. Instead of operating the vertical valve spindles directly from the eccentrics, the valve gear with oil dashpots and springs for closing the valves, was enclosed in the valve chest, and motion imparted from the gear to the valve spindles in the completely closed valve chests by means of oscillating shafts and bell cranks. A similar arrangement was chosen for the exhaust valves. The piston rod stuffing boxes also required special construction in order to provide for the most perfect packing possible. While SO_2 itself is an excellent lubricant, since the purpose of the packing is to prevent its escape, grease is used in the outer end of the stuffing boxes, and it was necessary to so construct the stuffing boxes as to prevent the piston rod from carrying the grease into the cylinder.

In operation it was found that the condensation in the SO_2 cylinder was remarkably small, and not the slightest difficulty was encountered from this score in spite of the absence of drain cocks on the cylinder.

It is well known that sulphur dioxide in the presence of atmospheric air, and more especially in the presence of water, rapidly oxidizes into sulphuric acid, which, of course, attacks metals. The necessity of very complete means for preventing leaking, not only at the engine, but in the condenser, is therefore apparent. The entrance of water into the engine is, however, impossible under normal conditions, since the internal pressures are higher than the atmospheric pressure, and the present state of the technical art enables joints and packings to be so constructed as to be perfectly tight. During the period of the earily experiments with apparatus at the High School, the vapor engine stood for more than a year filled with SO_2 and condensing water without giving the least trouble, and the parts of a new 60-hp engine for the same school have been filled over nine months and no trouble experienced. Numerous examinations have shown that everything remains continuously in excellent condition.

The vaporizer, or steam condenser, was of a cylindrical form about 10 ft. long, and contained 753 square feet of cooling surface. The SO_2 condenser was 41 inches in internal diameter, and contained about 1720 square feet of cooling surface. The power required for the SO_2 feed-pump was about ¾ of 1 per cent of the total power of the engine.

In the tests of this arrangement superheated steam of about 300 degs. C. was used. For the steam engine alone the best economy obtained was 11.15 lbs. of water per ihp-hour. The waste heat engine delivered at the same time an amount of energy amounting to 34.2 per cent of that of the steam engine. Consequently, the steam consumption for ihp-hour of the combined engines was reduced to 8.34 lbs. In this test the total output was 170 ihp-hour.

In the test corresponding to the above economy the admission steam pressure was 156 lbs., the temperature 588 degs. F., and the vacuum 24 inches. The admission vapor pressure was 128 lbs., the temperature 134 degs. F., and the pressure in the SO_2 condenser 33 lbs. above the atmosphere. The temperature in this condenser was 70 degs. F., and that of the entering and discharge circulating water, 50 and 60 degs. F., respectively. The mechanical efficiency of the whole arrangement was 85.5 per cent.

A number of tests were made in order to determine the relation of economy with the steam vacuum. The tests, which were comparative, extended over a range of vacua from below 21 to 28 inches, and demonstrated that the best economy of the combined machine was secured with a vacuum of 21 inches. The explanation offered for this is that with a low vacuum, and consequently smaller difference of temperatures in the low-pressure cylinder, the condenser losses in that cylinder are appreciably decreased, while the smaller amount of work delivered by the low-pressure cylinder is more than made up by the corresponding increase of work in the vapor cylinder. Professor Josse concludes that possibly still better results may be obtained with vacua less than 21 inches. It was not thought advisable to experiment with lower vacua for the reason that the safe limit of pressure in the vapor cylinder was 215 lbs., corresponding to a vacuum of about 21 inches.

It is pointed out that the percentage of gain to be obtained by the waste heat engine is dependent upon the specific steam consumption of the steam engine entering into the arrangement. That is to say, the larger the specific steam consumption of the steam engine, the greater percentage of power developed in the vapor engine; and there is a larger gain when the boiler supplies saturated steam than when superheated steam is supplied to the high-pressure engine cylinder. The vapor cylinder permits of a further slight gain of economy by utilizing the heat energy contained in hot condensation from steam jackets and intermediate receivers of the steam engine.

Professor Josse makes a digression in order to discuss the relative advantage of triple and compound-expansion engines where superheated steam is used. In order to test this question some experiments were made by running the triple-expansion engine of the High School with the intermediate cylinder cut out, and the result was that the economy was precisely the same when two cylinders were used as when all three were in service.

As to the greater amount of cooling water used with the waste heat engines, it is stated that it is advisable to use about 25 per cent more water than would be required by the steam engine alone. The power consumption of the water and circulating pump is about the same as that of the air pump of a jet condenser, assuming the same quantity of circulating water. A consideration of the relative sizes of the steam and vapor condenser leads to the conclusion that the former should have a surface of from 5 to 7½ square feet per ihp, and the latter from 20 to 25 square feet per ihp.

It is stated that the waste heat engine is not suitable for small steam plants, nor for those operated during but a few hours daily. In the case of a new design, the steam engine may be a two-cylinder compound engine with a third cylinder added for the vapor in place of the intermediate cylinder of the triple-expansion engine. The relative proportions of the three cylinders in this arrangement would be somewhat different from those customary for a triple-expansion engine. Owing to the lower vacuum carried, the low-pressure steam cylinder would be about 30 per cent smaller, and the cold-vapor cylinder would also be smaller than the intermediate cylinder of the triple-expansion engine, owing to the high mean pressure of the sulphur dioxide. It is stated that in consequence of the simple valve gear used with this cylinder, and the fact that it would have no steam jacket, it would be decidedly cheaper to build than the intermediate steam cylinder. The vaporizer, or steam condenser, would hardly be larger than a liberally-proportioned receiver. Such a combined steam and waste heat engine, it is stated, would certainly not cost more than a triple-expansion engine of normal output with jet condenser. In large combined engines of a capacity from 1200 to 2000 horse-power, Professor Josse believes that the data now available indicate that the steam consumption would be decreased by 7 lbs. per ihp per hour.

It is stated that the principle of the waste heat engine may also be economically applied to utilize the waste heat from boiler furnaces and gas engines, and that a test of this application will soon be made. Another application of this engine is in the utilization of the heat from hot water in places where such water naturally flows. As an example, it is stated that at some mountain mines in Chili, water brought to the surface has a temperature of more than 170 degs. F.

The waste heat engine, shown in Fig. 2, is now in operation in one of the stations of the Berlin Electric Lighting Company. In this station the steam engines are of 360 horse-power, and consume about 40 lbs. of steam per ihp-hour. The vapor engine installed utilizes 175 horse-power of the waste heat from the steam engines.

The pamphlet from which this is extracted gives data as to the cost of a combined steam and waste heat plant of 1600 horse-power, and the economy to be derived from such a combination. The cost of the plant complete, not including steam generating plants, is given at $51,000. The annual expenditure for fuel for a 1600-ihp steam engine plant on the basis of coal at $4.50 per ton, is given as $14,000 per year for 3000-hours' service. For a combined steam and waste heat engine plant of 1600 ihp the fuel cost is given as $3,400. The difference in cost between a combined plant and a steam engine plant of the same capacity is estimated at only $1,500.

University of Missouri.

One of the best endowed of the Western universities is the University of the State of Missouri, at Columbia, Mo. The buildings, equipment, etc., have cost more than $1,000,000, and the buildings, equipment, etc., have cost more than $1,000,000, and the income of the University, from all sources, in the next two calendar years, will be about $416,000 per year. Among the buildings there is an engineering building, one for mechanic arts, power house and a chemical laboratory, and an engineering laboratory will shortly be erected. A full course is given in electric engineering, in which especial attention is paid to alternating currents, testing and construction of electrical machinery, and long-distance electrical transmission of power.

Elements of Illumination—XXIX.

By Dr. Louis Bell.

THE problem of effective illumination is still further complicated when the object is a large building or group of buildings. The arcs with reflectors which may be so well utilized for illuminating a comparatively small object become almost useless on a large scale, owing to the total impracticability of furnishing from suitable directions enough light for the purpose. The lighting of a single monument may be regarded as a special case of the illumination often used on the stage, but architectural illumination is a matter very different from both this and from the illumination of large open spaces purely for utilitarian purposes. It has for its object the display in the most artistic manner, of the architectural values of great buildings and their surroundings. It is essentially decorative rather than utilitarian, and the methods must be governed by the effect desired to be produced rather than by considerations of rigid economy.

Such work must be done in connection with great expositions, important public places, and sometimes in a temporary manner for great civic functions. The object to be attained is no longer solely the illumination of a plane near the ground, but the bringing into splendid prominence architectural features which would otherwise be lost in the darkness.

The first fundamental rule in this class of work is to abandon any attempt to simulate daylight, and after providing for adequate illumination of the ground by means which shall not interfere with higher planes of illumination, to sketch in light the principal effects of the scene before the eye.

Illumination of a great mass of buildings by reflected light is out of the question. If of dark material, it is a sheer impossibility, and even if the buildings be white the shadow values of the daylight cannot be successfully imitated by radiants placed near the objects, which will therefore look either white and flat or mottled with petty shadows which melt in the distance into a muddy gray.

The configuration of the lights to be used in the luminous sketch that seems needful for the best artistic results may be roughly determined by making by daylight, or better, near sunset, a rough, clear line drawing of the scene to be illuminated from a rather distant viewpoint, the further as the scale of the work increases. Then the distribution of lights following the principal points and outlines of this drawing will give the main effects that one wishes to produce. The sketch may be filled up by adding necessary details not too brightly, and the ground illumination must be such as not to interfere with this general arrangement. Reflected light from the radiants thus distributed plays a useful part in adding to the general brilliancy of the effect without marring its artistic unity.

The result of this general method has never been so magnificently shown as in the lighting of the Pan-American Exposition now in progress at Buffalo. This was planned by Mr. Luther Stieringer, a pastmaster in the art of decorative lighting; in fact, the builder of the art itself. Two buildings illustrated in the ELECTRICAL WORLD AND ENGINEER, of May 18, show with beautiful distinctness the artistic value of the sketching principle just indicated. One, the great Electric Tower, 400 ft. high, is a perfect example of the application of the principles just laid down. This tower is the dominating note of the whole scheme of illumination, and it is therefore brought to an intensity greater than would be called for were it considered by itself. Even this would be indicated by a line sketch of the whole Exposition in grand perspective.

The treatment of a less important building is admirably shown by the other, the Temple of Music. It is strikingly beautiful, yet perhaps might have been improved by indicating some of the vertical lines in the lower part of the dome. A feature worth mentioning in the Electric Tower is the simultaneous turning on of all the lights and their gradual increase to normal brilliancy by the use of a huge motor rheostat.

In this method of illumination powerful radiants are both needless and harmful, since they interfere with the freedom of the sketching and blurr the effect by masses of reflected light. If used at all in the architectural work they should be used very sparingly, and Mr. Stieringer very wisely chose the 8-cp incandescent lamp as his unit in the great work at Buffalo. Number of lights, power of free sketching with them is what is wanted, and for this an 8-cp lamp is quite as effective and far more economical than one of higher power.

Arcs must not be allowed to intrude themselves on the effects thus produced, following the principle long ago laid down in these papers. When used as they may sometimes be, for ground or interior illumination, they should be so effectively guarded by opal globes that there shall not be a violent contrast in brilliancy between the various plans of illumination. At Buffalo Mr. Stieringer has dropped the arc altogether, save in certain features of display lighting, like the illumination of fountains and cascades by reflectors, and produces the ground lighting by clusters of incandescents. The real question, however, is not so much the choice of one or another source of light as the preservation of a uniform or skillfully graded tone of brilliancy in the general illumination. This is most easily secured by the use of incandescents alone, although there certainly are cases in which arcs could be used with admirable results as part of the general scheme. One difficulty with the use of incandescents heavily massed near the ground is the certainty of a number of them being burned out every evening, producing unsightly gaps in the symmetry of the display. Such failures are far less conspicuous at a distance, when the lights melt together. The general effect produced may be greatly modified by varying the number and intensity of the lights used. Small luminous units not too thickly crowded give a transparency, an airy, unsubstantial appearance, that is lost when the radiants are so powerful or so numerous as to render much of the structure visible by reflected light.

The principles of architectural illumination have been well understood and acted upon, though perhaps not definitely formulated for many years. Before the introduction of electric light reliance had to be placed on gas jets, lamps, and even candles for such work, and there is no doubt that very beautiful effects were produced, although at great cost of labor, and temporarily. The nature of the radiants was such as almost to preclude the possibility of overdoing the illumination, and only with the advent of electric lights has there developed a strong temptation to try for daylight effects, always a failure from the artistic standpoint.

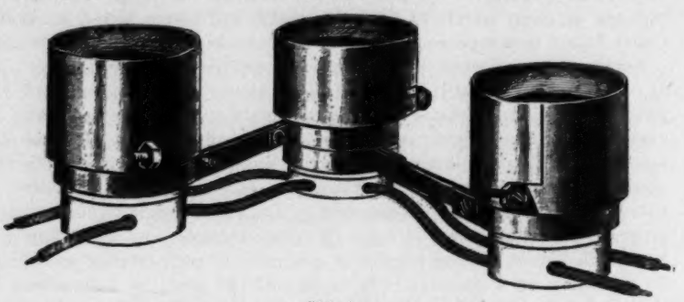


FIG. 1.

The absolute number of lights required to produce certain effects is more a matter of judgment than of calculation. If a row of radiants is intended to melt into a line of light, of course, far more lamps are needed than if one merely desires a row of star-like points. Both arrangements may be advantageously used even on the same building. The ordinary 8 or 16-cp lamps melt into a practically continuous line at 800 or 1000 times the distance between lamps, so that if, as on high buildings, they are normally to be viewed from a considerable distance, they may be rather widely spaced, while near the ground they may well be more closely spaced. A little tack will enable a certain perspective effect to be attained if desired.

The use of illumination by reflected light cannot well be combined with any other method, except as the lights used for the illumination may give enough surface reflection to enhance the general brilliancy. Therefore the beams from reflector arcs must be kept away from surfaces which are to be sketched out in lines of light.

Colored light can be effectively used with refector arcs, on white surfaces, on cascades, in fountains and the like, but is seldom successful when tried with incandescent lamps, save on a rather small scale. The difficulty lies in the dimness of colored bulbs and the failure of attempts to get delicate tints in this way. Colored glass bulbs are expensive and coated bulbs accumulate dust and are seldom weather proof.

Much decorative lighting is for temporary purposes, but with the present facilities for obtaining current and the temporary mountings that can readily be obtained, the work is comparatively easy.

Special receptacles for signs and decorative designs are now made in convenient form for quickly putting together and enable temporary work for special occasions to be very easily done. Fig. 1 shows one useful form of mounting device, in which the weather-

proof receptacles can be quickly strung together with clamps and held neatly spaced in any way desirable. For decorative work on a considerable scale the retaining clamps would, of course, be longer than here shown. There is a fine chance for art in turning on the lights in architectural and other decorative work. The water rheostat, bringing all the lights simultaneously from a dull red glow to full brilliancy, is by far the most comprehensive scheme for the purpose. In the absence of this or in permanent work of which only a part is regularly used, the circuits should be so arranged as to allow a perfectly symmetrical development of the lighting without throwing on a huge and sudden current at any one time.

In any and all decorative work the illumination must be subordinated to the general architectural effect. Sins against art in this respect are all too common. Imagine, for example, a Doric temple with arc lights at the corners of the roof and festoons of red, white and blue incandescents hung between the pillars. About a structure of such severe simplicity lights must be used with extreme caution, while more buildings can be treated with far greater freedom of decoration. It requires both fine artistic instinct and great technical skill to cope adequately with the problems of decorative illumination.

The tricks of the art are manifold and mostly meretricious. The facility with which electric circuits may be manipulated is a continual temptation to indulge in the ingenious and the spectacular without due regard for the unity of the results. Whirligigs, waving banners, rippling water, *et id omni genus*, are better suited to a Coney Island merry-go-round than to serious attempts at decoration.

Another class of work, hardly a part of ordinary lighting, but yet of considerable interest is the use of lights purely for decorative purposes in interiors, in halls and auditoriums for special designs, as part of the decorative scheme of ballrooms and the like. This is really a branch of the art due to electric lighting, since only by this means can it be rendered fully serviceable. Most branches of illumination are in a measure independent of the particular radiants employed, but the ease and safety with which incandescent lamps can be installed renders them peculiarly applicable to such interior work. In operating on a comparatively large scale all sorts of decorative designs can be carried out by means of 8 or 16-cp lamps strung together in receptacles in the manner of Fig. 1, or otherwise, temporarily mounted for the purpose. For work on a smaller scale, or in the preparation of very elaborate designs, other means may be taken.

How Insects Put Out the Lights of St. Paul.

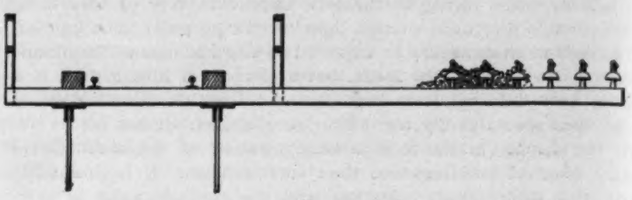
BY CHARLES L. FITCH.

IT is hard to believe that a slender, wasp-like fly, less than an inch in length, a thousand of which would scarcely weigh an ounce, should gather in sufficient numbers to shut down the electric lights of a large city, yet this is exactly what happened at St. Paul one day recently.

During the months of June and July of each year that section is visited by large numbers of a pale green diptherous insect familiarly known as the "shad-fly," possibly because of its resemblance to the variety which appears in more easterly localities about the time the shad are running. These little pests are most in evidence after dark in the neighborhood of the electric street lamps, about which they hold a nightly carnival, incidentally dropping on the back and neck of the passer-by, about which they crawl to his infinite annoyance. Their presence in the cities is undoubtedly due to the attraction of the electric lights, as their especial breeding ground is found in swampy neighborhoods and on the banks of rivers and lakes, where they appear in great numbers. The accompanying illustration shows the shad-fly full size.

The power for the St. Paul lights is supplied from Apple River Falls, some 27 miles away, in the State of Wisconsin, and the electric transmission line, which was built under the supervision of the writer and is operated at 25,000 volts, crosses the St. Croix River on the Wisconsin Central Railroad bridge. The wires, six in number, are here supported on 8-inch by 8-inch oak beams, as illustrated herewith, extending out 16 ft. from the south side of the structure at the level of the track, each wire being 18 inches from its neighbor, and over 12 inches above the supporting arm below.

A large portion of the power transmitted is utilized as direct current, through the medium of six-phase rotary converters, and when one evening about 8 o'clock, the converters went "out of step," thereby paralyzing the whole system, the attention of the operators



TRANSMISSION LINES SHORT CIRCUITED BY FLIES.

at the generating station was at once directed to the St. Croix bridge, some five miles away, by a series of brilliant electric discharges, which illuminated the whole heavens. The line was at once cut out, and an emergency crew dispatched to repair the supposed breakdown. They were much puzzled upon their arrival to find everything in perfect order, no evidenec of any short circuit being visible on either wires, insulators or cross-arms. After some delay the current was again turned on, and the cause of the trouble then became apparent, for the flies soon gathered in such numbers on some of the arms that they formed a solid bridge from wire to wire, and the flash of each discharge, while it destroyed thousands, only added fuel to the flames by attracting additional thousands to the spot.

The shut-down lasted about an hour, and it was found necessary to station an attendant upon the bridge, who was provided with a wooden hoe attached to a long pole, with which, from time to time, he dislodged the insects from the cross-arms, as soon as they collected in dangerous numbers. This incident is unique and probably unprecedented.

Figures of Manufactured Exports.

In four important articles of our manufactured exports there is a material reduction in the value of exports in 1901, compared with 1900. These articles are: (1) copper, a reduction of $14,500,000; (2) iron and steel, a decrease of $4,500,000, which is entirely accounted for by the absence of figures on the exports to Hawaii, to which the exports of iron and steel alone from the United States last year were over $5,000,000; (3) mineral oils, in which there is a reduction of $3,800,000 in value, due entirely to a reduction in the export price of oil. Taking the entire available list of exports of manufactures, numbering about 200 distinct articles or classes of articles, it is found that 60 per cent show an increase in value, as compared with last year, while in a considerable number of those showing a decrease the loss is entirely due to the reduction in price per unit, the actual quantities being in several cases greater and the values less than last year.

The following table shows some of the exports in 1900 and 1901 of manufactures in which the total in 1901 exceeded $1,500,000:

	1900.	1901.
Iron and steel and mfrs.....	$121,913,548	$117,319,270
Copper, manufactures of	57,852,960	43,267,021
Scientific instruments	6,435,766	7,361,231
Carriages and cars	3,694,138	4,210,108
Railway cars	2,558,323	4,195,019
Brass manufactures	1,866,727	2,007,450

Mosquitoes and Power Plants.

Newspaper reports from Connecticut state that the power house of the Norwalk, Conn., Traction Company was invaded by mosquitoes in swarms, a few nights ago, and the inmates were driven from the place. They finally hit upon the expedient of bathing their faces and hands in water in which tobacco had been soaked, which proved effective in discouraging the pests.

Recent Energy Meters.

Among electrical patents the class comprising energy meters has for several years been one of the best represented, one or more meter patents issuing weekly. Among the patents issued July 23 and 30 there are five relating to this subject, several of which are of unusual interest. One issued to J. H. Barker and J. A. Ewing, of Cambridge, England, combines with an energy meter an indicating device which gives a record of the rate of supply of current by causing contact to take place from time to time between an indicator and a record surface in the form of a scale blank over which the indicator moves in the course of its deflection. The contacts are made to take place more or less frequently, but are of short duration, so that during the greater part of the time the indicator is free to move in response to the changes in the rate of speed, and to exhibit the actual rate at any instant. Use is made of the mechanical movement of the energy meter to produce the necessary contacts of the indicator from time to time. The magnetic brake of the energy meter is pivoted and can turn about its axis of suspension against the action of a spring. This gives motion to the lower end of the indicator, the upper end of which gives a magnified indication of the amount of movement of the magnet brake, which movement corresponds to the rate at which energy is being registered.

Dr. Louis Bell, in a patent dated July 23, describes a multiple-rate meter whereby devices such as a motor may be automatically cut out and locked during the peak in the station load curve; or such devices may be used during the time of the peak, but at a higher rate for the energy consumed. A sealed starting box is provided for, say, an electric motor, the operating handle of which is accessible from the outside, and controlling devices are supplied by which the motor can be cut out and locked against further operation at times of high load. The automatic control of the device may be effected either by a clock which electrically releases the operating handle at certain hours, or by means of a control wire leading from the central station, whereby motors located at different parts of the distributing system may be simultaneously rendered operative. In order to permit the use of the motor at a higher rate during peak load, there is a mechanically-controlled device by which the circuits inaccessible from the outside of the starting device may be changed so as to operate the meter at a higher rate.

Walter C. Fish, in a patent issued July 30, describes an electric meter, in which movement of the recording device is produced as the resultant of a differential action of two armature windings, the torques of which oppose each other. The disk armature has two windings and two commutators. In one of the supply mains with which the meter is connected is a resistance having a very low temperature coefficient. One brush of each commutator winding is directly connected to the other supply mains; the other two brushes are connected, one at each terminal of the above-mentionel resistance. When there is no current flowing in the mains there will be no drop of potential across the resistance, and consequently the e. m. f. impressed upon the circuit of the two armature windings will be exactly the same, and there will be no motion. When current commences to flow it passes through the resistance in the main, across which there will exist a difference of potential proportional to the amount of current flowing. The current flowing through one winding will, therefore, be less than that through the other, and the armature will be given a motion proportional to this difference of e. m. f., and consequently proportional to the amount of current flowing in the main.

A patent granted July 30 to W. H. Pratt relates to means employed to register the energy consumed in a circuit including a storage battery, in which case it is desirable to provide for forward or backward motion so as to indicate on a single dial the condition of the battery from time to time. The invention consists in the use of a polarizing controlling device responding to the working current, whereby either a forward or backward starting coil may be thrown and kept in circuit. The polarized relay for this purpose has its magnetic field developed by a storage battery main passing in close proximity to its core, a winding to carry the heavy battery current being thus dispensed with.

A multi-rate meter described in a patent issued July 30 to F. P. Cox and C. E. Holmes has two or more dial frames, there being a clutch for engaging either train. The clutch is operated by a clock at definite times, thereby alternately releasing and engaging the several trains. Either train is locked against rotation when disconnected from the clutch, this being effected by spring-actuated clutch shoes.

CURRENT NEWS AND NOTES.

ENGLISH TO STUDY OUR SUBWAYS.—In the House of Commons on Aug. 8 Gerald Balfour, president of the Board of Trade, stated that the Government was considering the question of sending an engineer to American and Continental cities to inquire into the subway systems there and report on their advantages over the London tubular system.

TOKYO ELECTRIC RAILWAY SYSTEM.—Representatives now in the United States of the Tokyo Electric Railway Company are about to let a contract to American manufacturers for the equipment of the new railway system of Japan's capital. There will be three 1200-kw polyphase generators, which will furnish current for sub-station rotary converters for transformation to direct current. The municipality has required the use of the double trolley.

CARS WITHOUT ROOF.—The Transit Company, of St. Louis, Mo., has put into operation on its surface lines an open car without a roof, which has been named "Moonlight." The car will be run only at night when no rain threatens, and will be much like a huge motor vehicle. The cords by which the conductor signals the motorman run along the foothboards instead of overhead, and the only lights used are a bunchlight with a reflector at the rear end of the car. It is intended for pleasure rides.

STATE SCHOOL OF ELECTRICITY.—The proposition to secure an appropriation by the New York Legislature to establish a school of electricity in connection with Union College at Schenectady was defeated, but the project is to be accomplished by independent means. The General Electric Company has agreed to give $12,500, provided an equal amount is obtained from other sources. President Raymond announces that he has secured pledges for practically all of this sum, and that the new department will be at once instituted.

DYNAMO WORKING DRAWINGS.—Professor E. Arnold, of the Technical High School, Karlsruhe, Germany, is preparing a revision of the excellent collection of working drawings of direct and alternating-current machinery, which was originally published about two years ago. The direct-current section will contain about 40 new designs, and the alternating-current section about the same number, embracing the latest European practice in design and construction. The price of each section will remain 20 marks. The portfolios will be ready about December, and orders may be addressed direct to the author.

POWER FACTOR AND FREQUENCY METERS.—Two patents issued July 23 to P. M. Lincoln describe, one a power factor meter and the other a frequency meter. The former consists of two fine-wire coils mounted at right angles on an axis free to turn in a field supplied by a coil in series with one leg of the main supply circuit. The two fine-wire coils are connected in shunt across the devices of which the power factor is to be determined, one being in series with an inductance and the other in series with a non-inductive resistance—the currents flowing through the two coils being thus in quadrature. With unity power factor the current flowing through the coil in series with the resistance will be substantially in phase with the e. m. f., and the coil will take up a position at right angles to the magnetic field in which it is placed. With a lag of 90 degs. the other coil will take up this position, the first-mentioned coil being then parallel to the field. At intermediate positions equilibrium will be reached such that the angular movement of a pointer on the axis of the coils will show the precise angle of lag. The second patent describes the application of a similar arrangement to the determination of frequency. In this case the coil setting up the magnetic field is in shunt with the main circuit and contains in series with it an inductance and a capacity of such value as to produce a resonant circuit at normal frequency. The fine-wire coils are connected as in the previous case. At any other frequency than normal the current in the magnetic circuit will be out of phase with the e. m. f., and the coils at right angles will assume a new position at which the forces acting upon them are in equilibrium; the angular movement will then correctly measure the angle of lag, and on a properly calibrated scale will show the change in frequency. The application of the arrangement to indication of speed is also shown.

A SOCIALIST PLATFORM.—At Indianapolis on July 30, a platform was reported by committee to the National Socialist Convention. It advocates as "immediate demands" public ownership of all means of transportation, communication, and all other public utilities, as well as all industries controlled by monopolies, trusts and combines.

TROLLEY SLEEPING CARS.—H. A. Fisher, general manager of the Appleyard roads which radiate from Columbus, Ohio, announces that within one year the syndicate will be operating through sleeping cars on its lines from Columbus to Cincinnati, and that within two years there will be through service between Cincinnati and Cleveland.

CONVERTING A STEAM ROAD.—The Blackhills & Fort Pier Railroad is to be converted into an electric system this month. The Burlington Railroad operates the line. Owing to the heavy grades and the bad conditions with smoke and cinders, it has now decided to equip the road electrically. It is six miles long, connecting Deadwood and Lead City.

BRITISH PACIFIC CABLE AUTHORIZED.—The House of Commons, by a vote of 180 to 55, has passed the bill for the construction of the Pacific cable. Colonial Secretary Chamberlain explained that of the £2,000,000 necessary to build the cable, the United Kingdom would contribute five-eighteenths and Australia, New Zealand and Canada the rest.

CHEAP CABLE MESSAGES.—A cable dispatch from London of July 17 says: At a meeting to-day of the Eastern Telegraph Company the chairman, Sir John W. Barry, announced that in conjunction with the Post Office authorities, the directors of the company were formulating a scheme to enable the public, by means of a code, to cable to the Far East for about 2 cents a word.

STRUCK SIX TIMES.—The Hope Methodist Church at Belvidere, N. J., was struck by lighting for the sixth time on July 30. The lightning in almost every instance has struck in the same place, at the top of the tall spire. So common has the thing become that the people say when storms come, "Well, look out for the Methodist Church." If a shower comes on Sunday when the congregation is in the church, the pastor immediately dismisses them, telling them it is best to go home. The trustees are somewhat alarmed and have hired an electrician to make an investigation.

BOW BELLS ELECTRIFIED.—A dispatch from London of Aug. 3 says: Whatever may be the case with St. Paul's, partial damage has already been sustained by the historic Church of St. Mary-le-Bow, on Cheapside, the beautiful tower of which already leans 23 inches out of the perpendicular. This, it is stated, is caused by the vibration of the adjoining tuppenny tube, the Underground Electric road. The company has agreed to pay $5,000 by way of compensation. Meanwhile, owing to the dangerous condition of the belfry, the famous Bow Bells, that called back Dick Whittington, must remain silent until necessary underpinning operations are completed.

HARTFORD TROLLEY TO BOSTON.—The organization of the Stafford Springs Street Railway Company means the probable early development of a through electric railway line from Hartford to Boston. The company has a franchise right to build a trolley line from the terminus of the Hartford, Manchester, and Rockville Tramway Company's system at Rockville, through Stafford Springs to the Massachusetts State line, and the work of construction will begin as soon as the preliminary details can be completed. The promoters of the enterprise are making arrangements for building through various Massachusetts towns under the general railroad law, and entering Worcester where connections can be made with Boston, thus forming a through line between the capitals of Connecticut and Massachusetts. Conferences are being held with the local authorities of the various Massachusetts towns through whose streets it will be necessary to run the road in order to execute the project.

CAUSING MENTAL ANGUISH.—Two years ago a citizen of Columbia, S. C., brought suit against a telegraph company and received a verdict of several thousand dollars damages for "mental anguish," resulting from the non-delivery of a telegram. The Supreme Court decided that a person could not recover damages for mental anguish disconnected with and in the absence of bodily injury. The last Legislature passed an act making telegraph companies especially liable to damages for mental anguish caused by their negligence, even in the absence of bodily injury. The first case tried under this act has just been won by the plaintiff, who suffered because she supposed her husband was ill, when, in fact, he had telegraphed that he was all right. The telegraph company has appealed and is employing two of the strongest law firms in the State to fight the case in the Supreme Court.

DESTRUCTION OF TALL POLES.—With reference to the recent destruction by lightning of some very tall poles of the Western Union Telegraph Company in Texas, Mr. P. G. Tompkins, the manager of the American District Telegraph Company at Beaumont, Texas, writes: "The poles referred to were the two poles erected in May last at the crossing of the Neches River. They were 150 ft. long, stood 135 ft. out of ground, and carrid three 10-conductor cables. These poles were made of Michigan Cedar and of Washington fir (commonly called "Oregon pine"). They cost about $1,200 each. They were side guyed as well as wire guyed. The stretch between the poles was 854 ft. In the electric storm of July 15 the pole on the west bank of the river was struck by lightning, completely demolishing it, and in its turn it pulled over the other pole. An interesting fact connected with the destruction of these poles is that nothwithstanding they were completely surrounded by heavy iron side guys (four in number), reaching from the bottom of the pole to within 10 ft. of the top, making as perfect a "lightning rod" as could be desired, the rods failed to ward off the lightning, putting a damper upon the lightning rod agents' business. These poles have since been done away with and submarine cable used.

A LIVE WIRE NOT DEAD WEIGHT.—Our esteemed contemporary, the New York *Sun*, is responsible for the following, written more in humor than in anger: It contributes not a little to the gayety of the nations that the gentlemen in responsible charge of the East River Bridge do not know what not to say or when to say nothing. Commissioner Shea, in his laudable desire to correct the erroneous impression which the statement of some misinformed engineer has created, that the bridge is carrying dead weight, makes haste to say: "As to the statement that the bridge is carrying a lot of dead weight in the shape of wires and pipes and rails, I want to say that this is not so. We are carrying a pneumatic tube and wires, but all of these are in constant use and are not dead weight." Certainly not. The man who calls a live wire "dead weight" speaks without knowledge, and deserves to be answered according to his folly. The same is true of a pneumatic tube in use for the transmission of mails, and rails over which cars are continually running. All this is the livest kind of live weight, and the amount of it does not count. We should miss Commissioner Shea if for any reason he should pass into the penumbra of official eclipse. In his present position he is a source of great joy to the unofficial citizen, to whom he is ever ready to impart information.

SHIPS' COMPASSES.—Rear Admiral Bradford, chief of the Bureau of Equipment, has received an interesting letter from Lieutenant-Commander F. M. Bostwick, navigator of the Oregon, in which he describes the effect on the standard compass of a "ground" in the bridge electric circuit. While the Oregon was steaming up the China coast on course N. E. by N., the navigator reports that it suddenly became necessary to change the course about a point to the eastward by bridge and steering compasses, to make the allotted course by standard. Upon investigation it was found that the trouble lay with the standard compass. A time azimuth taken showed the deviation of the standard compass to be 10 degs. and 4-100 min. east, the tabulated deviation being 1 deg. and 4-100 min. Upon inquiry it was found that the bridge circuit had just been turned on, and later a "ground" was discovered. Experiments showed conclusively that the fault was due to this "ground." In order that this trouble may be avoided in the future, the Secretary of the Navy has authorized the chief of the Bureau of Construction and Repair to inform the commandants of the navy yards and the superintending naval constructors that hereafter the platforms for carrying the standard compass should, whenever practicable, be insulated from the structure of the ship by three-eighths of an inch of hard rubber fibre, and that the bolts securing platform stanchions to the structure should also be insulated by bushings and washers of the same material; also that all horizontal railings within 12 ft. of the compass should be made either of wood or Manila hemp rope.

SIX-PHASE ROTARY CONVERTER SYSTEM.—A patent issued July 23 to Edwin W. Rice, Jr., describes a method of connecting a six-phase rotary converter to a three-phase circuit. The secondary of each of the three transformers used in connection with the rotary is divided into two independent parts. One terminal of each of these parts connects with one of the six rotary terminals. The second terminal in one arrangement shown is connected with one of the secondary sections of another transformer, the other side of this section connecting with another terminal of the rotary. An advantage claimed for this system is that in starting the rotary converter from the direct-current side, it is unnecessary to open the leads connecting the alternating-current side of the converter to the transformer windings, as is necessary when only a single set of transformer windings was employed.

LOCALIZATION OF INSULATION STRAINS UPON BREAKING HIGH-POTENTIAL CIRCUITS.—In the case of lines of high-potential which possess a certain amount of capacity and self-induction, such as underground cables, it is hazardous to cause any sudden or abrupt change in the current flowing by opening and closing the circuit with an ordinary switch or circuit-breaker. Any such sudden make or break in the circuit usually produces a high resonant rise of potential, which is generally of an oscillating nature and causes violent surges of current back and forth in the line. In order to obviate this danger, E. W. Rice, Jr., in a patent issued July 23, proposes to place an inductance on each side of each switch terminal. By this arrangement the rise of potential which takes place upon making and breaking the circuit, together with result oscillations of current, are limited in their activity to the locality of the induction coils, which serve to damp out and suppress transmission of high e. m. f.'s to other portions of the line. If, therefore, any damage takes place due to breaking down of insulation, it will occur in the neighborhood of the inductance coils, and consequently in places where it is easily detected and remedied.

COMPENSATING ARMATURE WINDING.—A patent issued July 23 to Edwin W. Rice, Jr., describes a means for reducing the apparent self-induction of armature coils lying between pole pieces, thereby greatly decreasing the sparking in commutator machines both of the direct and alternating-current type, and decreasing any tendency to hunt in the latter. The method consists in the addition of a second winding superposed upon or intermeshed with the main armature winding, this additional winding being provided with a separate commutator, with which it is connected in the ordinary manner. Short-circuiting brushes are placed upon this latter commutator at segments corresponding to the portions of the armature winding lying between the poles. These brushes produce a short-circuit in the secondary winding, which is constantly progressing or shifting with respect to the conductors of the winding, but is fixed with respect to the interpolar space. By this means the self-induction of the coils in the main winding passing through the neutral region is so greatly reduced that practically no sparking occurs. In commutator alternating-current machines and rotary converters this same advantage is present, and in all alternating-current machines, whether provided with a commutator or not, any tendency to hunt which may exist may thus be prevented. It is stated that this method of preventing hunting is superior to the use of conducting bridges or other devices located upon the field magnetic structure.

A NEW FRANCHISE AT OTTUMWA.—The new franchise which has been granted the Ottumwa (Iowa) Electric & Steam Company is of peculiar interest to those connected with Iowa properties of the kind, as it is the first of its kind that has been granted by any of the larger towns of Iowa. Under the present Iowa laws a franchise ordinance after passing the city council must be submitted to a vote of the people for ratification. The new Ottumwa franchise is for 25 years. The company had a shorter one before, but wished to increase the plant and issue bonds, and to do this needed the 25-year franchise. The company operates 7½ miles of street railway, 137 alternating-street arc lamps, 100 commercial arcs, 6000 incandescents, a 500-volt power service, and 3 miles of exhaust steam heating mains. The new electric light franchise provides that all poles and wires shall be painted, and the latter shall at all times be kept well insulated. During the life of the franchise the maximum price for arc lamps of a nominal 2000 candle-power shall never exceed $75 a year for an all-night schedule, or $67.50 for a moonlight schedule. The rates for incandescent lighting are from 13 cents per kilowatt-hour for a consumption of 10 kilowatt-hours and under to 8 cents for a consumption of from 301 to 400 kilowatt-hours. The former rates were 15 cents for commercial and 18 cents for residence lighting, with a sliding scale down to the present rates for 151 kilowatt-hours. Power rates remain unchanged at 20 cents per kilowatt-hour, with a minimum charge according to the size of the motor. All city buildings are to be lighted free. Royal H. Holbrook, one of the leading young mechanical and electrical engineers of his State, took charge of the Ottumwa plant April 1, and is working to bring the commercial efficiency of his plant up to the high standard of the other properties with which he has been connected in an active and consulting capacity.

STREET LIGHTING IN MONTREAL.—In our issue of July 27 appeared a news item relating to proposals for the electric street lighting of Montreal. As stated in the note, the figure submitted by the Royal Electric Company, which has now the contract, was $95 per arc light per annum; the Lachine Hydraulic & Land Company, $90, and the Standard Light & Power Company, $99—all of the above for either a 5 or 10-year contract. The Imperial Electric Company submitted a bid of $85 for a 5-year and $80 for a 10-year contract. Among the bids were also two from companies that thus far have been doing no lighting in Montreal, one being the Shawinigan Water & Power Company, which submitted a price of $79.935 for a 5-year contract and $78.475 for a 10-year contract; and the St. Lawrence Power Company, which handed in a bid of $54.75 for a 5-year contract. No action has yet been taken owing to various claims of contending bidders, the most important being a charge of ambiguity with respect to the kind of lamp and service involved in the different bids. The Royal Electric Company specified that it would supply a 9.6-ampere or 480-watt open arc series lamp, that being the kind of lamp now in use in the city, and those interested in that Company claim that the article in the tender for bids has been interpreted by some of the bidders to mean any kind of lamp of 480 watts, including alternating-current enclosed arcs; and that as the Royal Company had based its bid upon a lamp costing more to operate, it was placed at a disadvantage with respect to those companies which had bid on other types of lamps. This company has consequently requested that it shall have an opportunity to submit figures on other types of lamp, should the council specify that one different from the type now in use may be employed. As to the bid of $54.75 per year, it is charged that the company which offered this bid has as yet no legal existence, having neither directors, shareholders, officers nor place of business, and the propriety is questioned of allowing the city to be used to assist the formation and financing of the company. The promoters, it appears, have obtained from the Dominion Government a right to the use of the surplus or overflow of the recent Soulange Canal at the nominal cost of 10 cents per horse-power per annum. It is also claimed that the new company is expressly restricted in its authorization to territory which does not extend into the city of Montreal. The entire matter of the street lighting contract is now being reconsidered by the council.

LETTER TO THE EDITORS.

Self-Starting Single-Phase Motors Without Brushes.

To the Editors of Electrical World and Engineer:

Sirs.—In a letter which appears in your issue of July 20, Mr. L. Gutmann makes the statement that though the motor described by me in your issue of June 22 may start with sufficient torque, the increased self-induction of the exciting circuit after switching would naturally reduce the available flux and consequently also the torque. I wish to say that this statement is in contradiction with the results of tests made with a small motor of this type and in which the torque became two or three times greater after the inductor M^2 was thrown in circuit. This accords also with the theory of the motor, which I might remark, is very complicated.

I agree with Mr. Gutmann that it is possible to construct single-phase motors which may be started under a load in a more simple manner, but for the special case where a large torque is not required and where the motor is to be reversed, the system which I have described has a particular value. This type of motor moreover seems

to me to be interesting from various points of view, for it is capable of several applications. I have tested its application to an arc lamp by putting one of the coils in shunt and the other in series with the arc. After several trials it was possible to obtain an automatic regulation of carbons; owing, however, to the fact that the moment of inertia of the armatures was relatively large, the motor only began to regulate with difference of potential too large for practical operation, and for the same reason did not cease to act until the distance between the carbons had become too small.

Prague, Bohemia. J. Fischer-Hinnen.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

Dynamos, Motors and Transformers.

Rectifying Alternating Currents by Means of Aluminum Valves.—E. H.—After some historical notes he gives the French Academy paper of Pollak in full, an abstract of which was recently noticed in the Digest. He has succeeded in forming aluminum plates to be used at 200 volts. He used for this purpose as electrolyte a slightly acid solution of phosphate of potassium, through which he sends a direct current. The first operation consists in cleaning the plates in a slightly concentrated solution of caustic soda, in order to remove the impurities. During the formation the purified plate gets "irisated." A plate formed for 200 volts, when placed in a circuit, even of low tension, gives off a little gas. A small current passes continuously in the apparatus. As a result of the purely chemical action of the electrolyte upon the "dielectric layer," it is slowly reduced. A certain current is therefore necessary to recompose by electro-chemical action what has been decomposed by purely chemical action (local action), and to establish thus the equilibrium between these two actions. The current required to maintain this equilibrium depends mainly on the purity of the plates and represents the "no-load loss" of the apparatus. The efficiency of the apparatus is 75 to 80 per cent for a system of four cells with purified aluminum plates, at a normal load and a frequency of 40 cycles per second. The aluminum plates, when left in the electrolyte during the periods of no load, lose by and by their dielectric layer and must be formed again before every application. This disadvantage can be easily overcome by removing the electrolyte from the cell during the periods of rest. When dry, the aluminum plates do not lose the dielectric layer. When the apparatus is working, much heat is developed with the result that the efficiency decreases and the plates finally dissolve. The maximum limit of temperature, up to which the apparatus works satisfactorily, is 40 degs. C. Artificial cooling is therefore required. It is thought to be desirable not to cool with water. He uses therefore the following arrangement to retard the moment at which the temperature increases above the critical limit. He employs a receptacle much higher than the plates, so that the column of electrolyte has a height several times that of the plates. In his experiments the height of the electrolyte was three times that of the plate. The current density was 1 ampere per square decimeter of the surface of the aluminum plates. The time during which the apparatus could be satisfactorily used as rectifier was four hours. At the end of this time the temperature had increased to 40 degs. C. He also gives data on experiments made with an apparatus consisting of four cells and used for charging a battery of 70 accumulators, alternating current at 110 volts and 40 periods being furnished from supply mains. After 2¼ hours the temperature was 15.6 degs., the density of the electrolyte 1.049, the current 4.5 amperes, the voltage 143.5; after five hours, 28.8 degs.; density, 1.044; 5.5 amperes, 154 volts; after six hours, 32.6 degs.; density, 1.042, 5.8 amperes, 156 volts. The wear and tear of the apparatus consists in the electrolyte becoming more and more alkaline and the plates becoming destroyed by the hydrogen bubbles. When a plate has been used for 500 to 800 hours, it is wholly destroyed. It is impossible to connect several such cells in series, either as rectifiers or as condensers. After a short time the tension diminishes in some of the cells and increases correspondingly in others, until the tension becomes too high in one or several cells, and the current passes in both directions. This phenomenon is due to the fact that it is impossible to make two cells exactly identical. The rectifier of Pollak has been exhibited in a session of the Internat. Soc. of Elec. in Paris. The present author points out which enormous advantages, especially for traction purposes, a rectifier based upon these principles, would have, if the difficulties mentioned above can be overcome.—*L'Ind. Elec.*, July 10.

Synchronous Motors and Alternators in Parallel.—Russell.—The conclusion of his "Notes on the theory of synchronous motors and of alternators in parallel." This part deals with the power factor of a synchronous motor, and with the theory of two equal alternators working in parallel. Some of the conclusions of his article are as follows: There is only one position of lag or lead of a synchronous motor on a given load where the equilibrium is stable. There is a necessity of adjusting the excitation of both the motor and the generator where it is wanted to get the maximum efficiency. It is misleading to refer to a synchronous motor as having a certain power factor at a particular load. The power factor of a motor circuit is a variable that depends not only on the shape of the wave of the generator, but also on what is happening outside of the motor circuit. The greater the excitation of two alternators working in parallel, the nearer the angle of lag between the synchronizing e. m. f. and the synchronizing current is to 45 degs., and the less the resistance of the circuit of the armatures (Mordey's rule), the better will they work in parallel. Alternators will in some cases cease to work in parallel on heavy inductive loads. This could be remedied by connecting condensers or over-excited synchronous motors eithers directly or through the medium of a transformer to the bus-bars.—Lond. *Elec. Rev.*, July 19.

REFERENCES.

Theory of the Synchronous Motor.—Blondel.—A long article, illustrated by diagrams, in which he develops what he believes to be the simplest theory of the synchronous motor. He uses the graphical method and applies to the investigation of the synchronous motor the theory of the "two reactions" (direct and transversal), which he had formerly worked out for the alternating-current generator. (See Digest, Dec. 9, 1899.) His graphical method is comparatively easy and gives a good insight into the action of the synchronous motor. It may also be applied to the theory of the synchronous converter. After a general discussion of the problem the method is applied to several special cases. The article is well illustrated, but is too theoretical to be abstracted briefly.—*L'Eclairage Elec.*, June 22.

Diagrams of the Action of an Alternator.—Barbillion.—An article in which he gives the diagrams respresenting the working of an alternating-current dynamo, which is connected to any circuit. He first discusses the most general case, and then the following typical cases: Constant-current distribution and constant potential distribution.—*L'Eclairage Elec.*, June 15.

The Regulation of Alternating-Current Generators.—A. S. McAllister.—An illustrated article dealing with the causes of variation of terminal e. m. f. with change of magnitude or character of load. The author points out wherein European and American alternators differ in the shape of armature slots, and discusses the counter e. m. f. of self-induction. The effect of armature resistance and reactance on the terminal e. m. f., and the effect of the armature current phase upon the field.—*Am. Elec.*, Aug.

Power

Design of Electrically-Driven Factories.—An editorial calling attention to some special points mentioned in Aldrich's A. S. M. E. paper on "Requirements of electricity in manufacturing work." Electric driving for large works has been proved to be the most economical method, and it is decidedly one of the chief merits of electric transmission that the producer can arrange both his buildings and machinery as best suits the economic production of his wares. The site for buildings may be chosen independent of power considerations, and located on most suitable ground. There is no necessity for buildings being placed around or adjacent to the power house, as required for mechanical connections to engines or turbines. "We

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are afraid that too often the British manufacturer designs his buildings and groups his shops first, and only when the construction work has commenced does he start to consider whether he will transmit the power by shafting or by electricity." As another advantage of electric driving the ease is mentioned with which future areas of work may be planned, irrespective of power considerations. "It is with the use of electric power from an outside source that the unlimited expansion by small steps may be utilized to the greatest extent."—Lond. *Elec.*, July 19.

The New Buffalo Terminal Transformer Station.—WOODBURY.—An illustrated article on the new terminal transformer station of the Cataract Power & Conduit Company, at Buffalo, N. Y. There are seven transformers in the station, connected in two batteries of three each, with one to spare in case of an emergency. The primary and secondary switchboards have each two sets of bus-bars, three transformers being connected to each set. The station receives about 14,000 kilowatts over three three-phase transmission lines from the power house at Niagara Falls at an e. m. f. of 22,000 volts, and delivers it at 11,000 volts, three-phase to the underground system of the city.—*Am. Elec.*, Aug.

REFERENCE.

Utilizing the Sun's Energy.—THURSTON.—An article on the practicability of solar motors.—*Cassier's Mag.*, Aug.

TRACTION.

REFERENCES.

London Electric Tramways.—An article on the recent formal opening of the system of the London United Tramways, and a brief description of the power house in High Street, Chiswick. To supply the outlying portions of the system three-phase currents will be transmitted to synchronous converter sub-stations.—Lond. *Eng'ing*, July 12.

Polyphase Traction Plant.—H. S. MEYER.—A reply to the criticism of Eborall, noticed in last week's Digest. He sustains all his former statements.—Lond. *Elec. Rev.*, July 19.

Third-Rail Electric Railway.—An illustrated article on the Albany & Hudson Railroad.—*Elec. Rev.*, July 20.

The Sprague Multiple Unit System.—CHILTON.—The fourth article on this system, the present article dealing specifically with the safety provisions.—*Am. Elec.*, Aug.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Resonance Phenomena in Direct-Current Circuits.—ARMAGNAT.—There can be, of course, no resonance phenomena in a circuit in which a strictly continuous current is flowing. In practice, however, an industrial direct current is generally the sum of a strictly continuous current and superimposed periodic currents of different frequencies. This can be proven by plotting the waveform of a so-called industrial direct current by means of an oscillograph. The superimposed periodic currents are often much greater than one might suspect. The e. m. f. curve furnished by a Gramme ring dynamo, giving 60 amperes at 120 volts, is nearly a straight line, but shows superimposed teeth, of about 1 to 2 volts maximum amplitude. When a four-polar motor with toothed armature, with 24 commutator segments, and running at 20 r. p. s., is connected to the circuit, a periodic perturbation of the frequency 480 is introduced, the maximum amplitude being nearly 14 volts. It is very easy to realize the electric resonance by the well-known method of condenser and self-induction coil in series. By this means, which is the same which has been used by Pupin for the analysis of alternating-current curves, one can obtain very increased voltages, and from their measurement one can determine the effective value and the frequency of the alternating current which must be superimposed on an exactly continuous current, in order to obtain the same waveform. This is worked out mathematically. This case is very similar to the practical case that a circuit contains self-induction coils and cables, the latter representing a certain capacity.—*L'Eclairage Elec.*, June 29.

ELECTRO-PHYSICS AND MAGNETISM.

Masses Smaller Than Atoms.—J. J. THOMSON.—A very lucid and interesting review of the work done in recent years, which has led to the assumption of "Bodies smaller than atoms." He gives an account of the experiments by which the charge and mass of the particles occurring in the cathode rays inside a discharge tube have been determined. The mass of each of these particles is only about 1-1000 of that of a hydrogen atom. These negatively electrified particles which he calls corpuscles, have the same electric charge and the same mass, whatever be the nature of the gas inside of the tube or whatever the nature of the electrodes. The charge and mass are invariable. They therefore form an invariable constituent of the atoms or molecules of all gases and presumably of all liquids and solids. These corpuscles have not only been found in cathodic rays, but are given off by incandescent metals, by metals when illuminated by ultra-violet light, and by radio-active substances; in fact, in every case in which the transport of negative electricity through gas at a low pressure, "i. e., when the corpuscles have nothing to stick to," has been examined, it has been found that the carriers of the negative electricity are these corpuscles of invariable mass. A very different state of things holds for the positive electricity. The positive electricity is found to be always connected with a mass which is of the same order as that of an ordinary molecule and which, moreover, varies with the nature of the gas in which the electrification is found. "These two results, the invariability and smallness of the mass of the carriers of negative electricity, and the variability and comparatively large mass of the carriers of positive electricity, seem to me to point unmistakably to a very definite conception as to the nature of electricity. Do they not obviously suggest that negative electricity consists of these corpuscles or, to put it the other way, that these corpuscles are negative electricity, and that positive electrification consists in the absence of these corpuscles from ordinary atoms? Thus this point of view approximates very closely to the old one-fluid theory of Franklin. On that theory electricity was regarded as a fluid, and changes in the state of electrification were regarded as due to the transport of this fluid from one place to another. If we regard Franklin's electric fluid as a collection of negatively electrified corpuscles, the old one-fluid theory will, in many respects, express the results of the new." Negative electricity, i. e., the electric fluid, has mass; positive electrification is accompanied by a diminution in mass. He then discusses the motion of the charged corpuscles and the obstruction offered to the passage of the corpuscles through different substances. He further discusses the existence of free corpuscles or negative electricity in metals, and points out the cosmical effects produced by corpuscles.—*Pop. Sc. Mo.*, Aug.

Influence of Oscillations on Electrolytes.—MORRIS.—A brief article on the work of Broca and Turchini, who have discovered that a disruptive discharge with electric waves of from 350 to 400 meters in length—i. e., with oscillations at the rate of about a million per second—has very different effects on an electrolyte in the circuit from those produced by an ordinary galvanic current. Under certain conditions—i. e., when the electrolyte is a relatively very good conductor—disruptive sparks of great power are produced in the electrolyte itself. This shows that to oscillations, at least of the particular frequency above mentioned, the electrolyte behaves almost as a dielectric. This is undoubtedly the cause of the transparency of electrolytes to light, a transparency which it was impossible to explain by means of the ordinary electromagnetic theory of light. Some details of the experiments of Broca and Turchini are given.—*The Elec. Chem. & Met.*, July.

Calorimetric Measurements of Electric Oscillations.—HARMS.—An account of some experiments which he has made with the bridge arrangement for rapid electric oscillations, suggested by Nernst. Working with waves 10 m. long, he found that in the case of alcohol the telephone minimum became very bad, much worse than in the case of substances conducting 100 times better. This could only be due to anomalous absorption in alcohol. He used a calorimetric method for proving the existence of such absorption. If, on the other hand, Ohm's law is to preserve its validity in the domain of anomalous absorption, the resistivity must be taken as varying with the frequency. He used a bulb provided with platinum electrodes and a narrow thermometer tube, and proved the existence of anomalous absorption in five different alcohols.—*Ann. der Phys.*, No. 7; abstracted in Lond. *Elec.*, July 19.

Hertzian Waves in Thunderstorms.—LARROGUE.—"The influence which thunderstorms exercise at a distance of thousands of miles upon persons affected with certain nervous diseases, long before any physical instrument announces an atmospheric disturbance, suggested to F. Larrogue that Hertzian waves emitted by thunderstorms might possibly be propagated over enormous distances through the middle and higher atmosphere by means of something corresponding to relays." He has made experiments with an elementary kind of "receiver" in the shape of a horizontal plate of zinc, 40 cm. in diameter, earthed by a thin copper wire, containing a spark-gap

in a dark cellar. He has made several series of nocturnal observations, while severe thunderstorms were far away and the sky was serene at the place of observation.—*Comptes Rendus*, July 1; abstracted in Lond. *Elec.*, July 19.

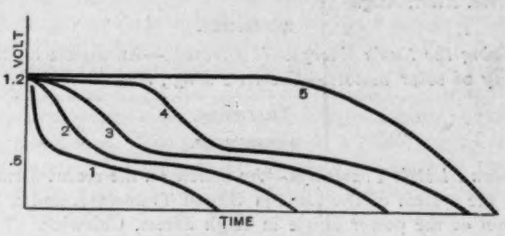
Natural and Radio-Active Air.—ELSTER and GEITEL.—They point out some analogies between air in its natural state and air which has been blown over radio-active substances. Such air imparts to other substances a temporary radio-activity, which can be considerably enhanced by giving these other substances a negative charge during exposure to the air. A similar kind of radio-activity may be produced by ordinary air, by exposing a negatively charged piece of wire gauze for several hours to the open air. The wire gauze then behaves like a body of feeble but distinct radio-activity. It imparts electric conductivity to air, even across a piece of aluminum foil, and they have even obtained photographic effects.—*Phys. Zeit.*, July 6; abstracted in Lond. *Elec.*, July 19.

Röntgen Ray Tubes.—A reprint of the report of the jury in the Röntgen ray tube competition of the British Röntgen Society. The tubes were mainly examined regarding definition, penetration, photographic effect and price. It is noteworthy that about 75 per cent of the tubes failed to satisfy the required tests for definition, and in the opinion of the jury the attention of makers of tubes should be drawn to this defect, because unless a tube defines well, all other advantages it may possess are to a great extent valueless for most of the purposes to which Röntgen ray tubes are put.—Lond. *Elec.*, July 19.

Hall Effect and Resistance of Bismuth.—VAN EVERDINGEN.—An account of experiments made with small columns of pure bismuth, cut from a crystal, some parallel to the main axis, and the others at right angles of at an angle of 60 degs. to it. The Hall effect was found to be large when the magnetic force is normal to the main axis, very small when the two directions are parallel and follows an ellipsoid of revolution for any intermediate angle. A similar ellipsoid may be constructed for the resistivity when the substance is not placed in a magnetic field.—*Phys. Zeit.*, July 6; abstracted in Lond. *Elec.*, July 19.

ELECTRO-CHEMISTRY AND BATTERIES.

Electrolysis of Fused Salts.—LORENZ.—An account of some investigations which have recently been made in the electro-chemical laboratory of Zuerich on the electrolysis of fused electrolytes. He describes the following galvanic cell: Carbon electrode, fused lead, fused chloride of lead, gaseous chlorine, carbon electrode. Such a cell gives a constant e. m. f. at the galvanometer for several hours, provided that the electrolyte at the anode is carefully separated from the electrolyte at the cathode and that the chlorine gas is held under constant pressure. The results obtained are in good agreement with Helmholtz's formula for the relation between the e. m. f. of a cell, its temperature coefficient, and the heat-toning of the chemical processes in the cell (the modified Thomson rule). Besides cells with chloride of lead, analogous cells with chloride of silver and with chloride of zinc were investigated. The e. m. f. of the cell with chloride of lead in volts was found to be 1.2818-0.000584 (t-506 degs.), and that with chloride of zinc equal to 1.662-0.000751 (t-430 degs.), where t is the temperature in degrees C., the temperature coefficient of the cell being constant in the limits between 506 and 890 degs. and between 430 and 660 degs. for the chloride of lead and for the chloride of zinc cells, respectively. Such cells act exactly like "fused storage batteries," their action being reversible. In quantitative investigations regarding the validity of Faraday's law for fused electrolytes the following trouble is generally experienced. The fused metals are very liable to dissolve in their fused salts. Dark colored "metallic fog" is formed which is distributed in the fused electrolyte. Diffusion and convection bring it from the cathode to the anode where it combines again with the deposited chlorine, so that the output of electrolytic deposition becomes smaller than it ought to be according to Faraday's law. Exact researches have shown that the recombination of the metallic fog with the chlorine takes place essentially under the influence of the anodic carbon, "which hereby plays the part of a contact substance." While the combination of the metallic fog with chlorine also takes place when the chlorine gas is blown into the fog by means of a glass tube, this combination is much slower than when it takes place with chlorine gas electrolytically produced at the anodic carbon. (It is perhaps interesting to note that the author does not attribute this fact to the properties of "nascent" chlorine, but to the presence of a "contact substance"). The e. m. f. of a cell with chloride of lead, as described above, is about 1.2 volts. When, however, the "metallic fog" starting from the cathode reaches the anode, the e. m. f. drops suddenly to 0.6 to 0.8 volt. He has a special arrangement by which he can regulate the arrival of metallic fog at the anode. When he prevents new metallic fog from reaching the anode, the e. m. f. suddenly rises again to 1.2 volts. It is therefore evident that the dropping of the e. m. f. is due to metallic fog reaching the anode. In order to obtain an output exactly corresponding to Faraday's law, it is necessary to prevent as much as possible the formation of such metallic fog, or to prevent it at least from reaching the anode. This may be accomplished by using a relatively low temperature and by separating mechanically the electrolyte at the anode from the electrolyte at the cathode. He then describes the following interesting phenomenon. Chloride of lead was electrolyzed in a simple V-tube with carbon electrodes in the two arms of the tube. After it had been electrolyzed for a certain time with constant current, the whole apparatus was filled with the metallic fog. The current was then broken and the cell discharged like a galvanic cell. The curve of discharge is the curve 1 in the adjoining diagram. The cell was then



DISCHARGE CURVES.

charged again with the same constant current as before, and again discharged. Charging and discharging was repeated several times. The curves which correspond to the several discharges are plotted in the diagram as the curves 1, 2, 3, etc. The characteristic features are that in the first discharge the voltage goes instantaneously down from the normal value 1.2 to about 0.5; in the second discharge the e. m. f. remains longer at the normal value 1.2 volts, still longer in the third discharge, and so on. This diagram is typical. Chemical analysis showed that during the first part of the experiments more chlorine was lost than metal; i. e., when, for instance, the metal obtained at the cathode was 70 to 80 per cent of the theoretical amount, the chlorine obtained at the anode was only about 40 to 50 per cent of the theoretical amount. No higher chlorine compounds of lead could be detected in the anode space. It was found that the phenomenon is due to the fact that the carbon is filled gradually with chlorine. The losses of chlorine are therefore due to the absorption of chlorine by the carbon electrode. When it is "saturated" with chlorine, the amounts of chlorine and of metal obtained are the same amounts in per cents of the theoretical amounts. The discharge curve is then the curve 5 in the diagram in which the e. m. f. keeps up the normal voltage 1.2 for the longest time.—*Zeit. f. Elektrochemie*, July 4.

Niblett Traction Cell.—An article on a new British traction accumulator, which has been devised by Niblett and will shortly be placed on the market. As "the result of some months' testing" the following particulars are given: Gross weight of complete cell, including vessel and electrolyte, 24 lbs. 9 ounces, normal discharge rate 16 amperes, current density of positive surface at normal discharge 1 ampere per 7 square inches, capacity 160 ampere-hours, capacity per pound of complete cell 6.55 ampere-hours. These results are obtained with a fall of potential to 1.75 volts per cell. The metallic conductor used is of small dimensions and light weight. "It forms the backbone of a frame wherein the active material is contained, and is so arranged that all those parts immersed in the electrolyte and not covered by the active material are insulated. By this arrangement all the lead salts are brought under direct electrolytic action." The active material "in both the positive and negative plates is not the usual lead oxides, but is a compound of lead salts produced electrolytically and is of a conductive nature. When set and properly seasoned the material is of a stone-like nature," while the necessary porosity is claimed for it. It is claimed that the cells can be formed very rapidly; that 2.2 to 2.3 volts per cell is sufficient to effectually recharge, and that there is no tendency to bending or buckling. With thinner plates the current density on both charge and discharge may be very much increased. "Thus, in the case of the thinnest elements yet tried, rates of discharge of 1 ampere per square

inch of positive surface have been obtained, the e. m. f. remaining practically constant. By working at this current density cells can be constructed which can be fully discharged or charged in less than one hour, without great loss of capacity or efficiency." So far plates varying from 0.1 to 0.75 inch thick have been tested.—*The Elec. Chem. and Met.*, July.

Electrolytic Deposition of Copper.—SAYER and SPIERS.—A continuation of their article. They discuss the changes in the constitution of the electrolyte itself. The fundamental change that the current brings about in the electrolyte is the conversion of cupric ions at the cathode into cuprous. Cuprous sulphate is next formed. In neutral solutions hydrolysis occurs and cuprous oxide is therefore deposited. In acid solutions the cuprous sulphate is stable and remains in solution. For the copper deposition to take place at a maximum efficiency, the number of cuprous ions in solution must remain constant. This is the case in strongly acid solutions, where the number of cuprous ions capable of being held in solution is limited, consequently, when this limit is reached further cuprous ions are converted into cupric, and copper is deposited. As mentioned above, the prime action of the current on a solution of cupric sulphate is to convert cupric ions at the cathode into cuprous ions. If, in consequence of stirring, these cuprous ions be brought over to the anode, they are retransformed into cupric ions, and a slime of copper and cuprous oxide is deposited on the anodes. In this case less copper apparently dissolves than is deposited, and the solution becomes poorer in copper. This is particularly the case where the cuprous ions exist above a certain limiting concentration and in neutral solutions. It is highly important to have free acid in the electrolyte; it prevents the deposition of cathodic copper contaminated with cuprous oxide; it prevents the precipitation of an anode slime, and above all, it greatly decreases the resistance of the solutions, and thus enables very low voltages to be used in the commercial refining of copper. They give a curve which shows how, in a particular case, the voltage at the bath terminals decreases with the percentage of free acid in the solution, the curve becomes practically asymptotic at an acidity of about 15 per cent, so that, as far as economical reasons merely are concerned, there is no advantage in increasing the acidity above that amount. They then give a curve for weight of deposit, as depending on the percentage of acid. They also reproduce the corrosion curve, the variations in both curves more or less correspond. The following are the approximate constitutions of some of the solutions used at varius times and at various refineries, mostly in the United States: 9.25 to 9.5 per cent acid and 13 per cent bluestone; 6 per cent acid and 16 per cent bluestone; 5 to 6 per cent acid and 15 to 25 per cent bluestone. In no case is the acidity as high as the 15 per cent referred to above.—*The Elec. Chem. and Met.*, July.

An Iron Cathode in a Solution of Nitrate of Ammonium.—KAUFMANN.—A German Electro-Chemical Soc'y paper. He has confirmed the phenomenon found by Haber, that when a solution of nitrate of ammonium, saturated at 0. deg. C., is electrolyzed in a cell with a porous plate, with a carbon anode and an iron cathode, at a low current density at the cathode (0.02 ampere per square decimeter), the iron of the cathode dissolves and the electrolyte at the cathode gets a yellow color. He has investigated this phenomenon and has found that it is due to the fact that during electrolysis at the cathode a solution rich of ammonia and of nitrate of ammonium is formed. He has also found a new ferroso-ferric oxide, which appears to be of practical importance. There are given two prints of a picture of Faraday, the one printed with the old ferroso-ferric oxide, the other with the new one. The former has the chemical formula Fe_3O_4, the latter Fe_3O_{11}. The print obtained with the former is black with a brown shade, that obtained with the latter is deep black. —*Zeit. f. Elektrochemie*, June 27.

Extracting Metals from Ores.—An editorial note calling attention to the well-known fact that at high temperatures calcium carbide has very powerful reducing properties. By igniting mixtures of the chlorides of metals with calcium carbide it is possible to extract the metals in almost a pure state. Working on the same lines, Geelmuyden, over ten years ago, observed that one could readily reduce most of the metallic sulphides (but not that of aluminum) by means of calcium carbide, the resulting calcium sulphide being an exceedingly stable body, even at the temperature of the electric furnace. Bullier has even succeeded in recovering metals directly from mixed sulphide ores, without the usual preliminary roast, and at an efficiency of about 90 per cent. In the case of copper pyrites the metallic ingot obtained consists of two well defined layers, the one of copper and the other of iron saturated with carbon.—*The Elec. Chem. and Met.*, July.

REFERENCES.

Theory of Electro-Chemistry.—JONES.—The first part of a serial on "Selected chapters in electro-chemistry." This deals with the theory of the osmotic pressure.—*Elec. Rev.*, July 20.

Electrolytic Production of Amines.—CHILESOTTI.—An account of an investigation of the electrolytic reduction of aromatic mononitro-compounds to amines, especially of the methods of Boehringer and of Elbs and Silbermann.—*Zeit. f. Elektrochemie*, July 11.

Copper.—FROMENT.—An article on the electrolytic method of refining copper and on alloys of copper and magnesium.—*L'Elec.*, June 22.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Rectifying Alternating Currents by Means of the Hall Effect.—DES COURDES.—When an alternating current J is supplied to a coil S and a bismuth plate D in series, as shown in the adjoining figure, then a D'Arsonval mirror galvanometer G connected to the lateral electrodes f and g indicates a direct current i. This is due to the fact that the main current J and the magnetic field, produced by it, change the sign simultaneously. When the connections a and b are reversed, the direct current i changes the sign. A more practical arrangement is shown in the second figure, where the alternating current is supplied to the windings of a laminated electromagnet S, while the Hall plate is placed in the air-gap. The direct current i may then be measured by an ordinary commercial instrument. He shows theoretically that this method of changing alternating current into direct current is of no commercial use, as the efficiency is very low, certainly below 2 per cent. The arrangement is, however, well adapted to measuring purposes, for the determination of the numerical coefficient of the Hall effect, for devising a dynamometer, and for the direct analysis of the wave form of magnetic fields, i. e., for the determination of the single co-efficients of the Fourier series without having determined before the waveform of the curve.—*Phys. Zeit.*, July 6.

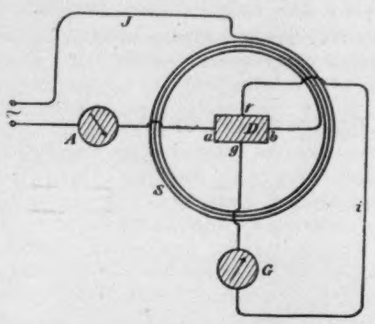


FIG. 1.

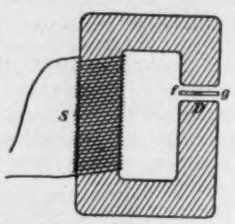


FIG. 2.

Pyrometers.—ROSENHAIN.—The conclusion of his illustrated article. The Callendar recorder and the Roberts-Austen pyrometer of the photographic type are described and illustrated. The two methods of pyrometric recording—the Callendar and the photographic—are compared. In favor of the Callendar is the fact that it avoids the trouble and expense of photography. In favor of the Roberts-Austen instrument are the greater simplicity of the photographic recorder, the absence of delicate moving contacts, and the greater sensitiveness and quickness of action. The question how to support the thermocouple in the electric furnace is very briefly discussed. It is admitted that the problem of obtaining continuous records of furnace temperatures much above 1200 degs. C. it not yet satisfactorily solved.—*The Elec. Chem. and Met.*, July.

Silver Voltameter and the Electro-Chemical Equivalent of Silver and Copper.—RICHARDS, COLLINS and HEIMROD.—They use a silver voltameter of the following form. As cathode a platinum pot is used, as anode a silver rod, covered with filtering paper. The anode is placed in a porous cup, the electrolyte at the anode is kept at a lower level than the electrolyte at the cathode. A silver nitrate solution of 10 per cent is used. Comparison with other silver voltameters show that nearly all other types give incorrect values, due to the fact that at the anode a reducing agent is formed which, when it reaches the cathode, causes a deposit of silver independent of the current. By keeping the electrolyte at the anode at a lower level, they

prevent the electrolyte around the anode to diffuse over to the space around the cathode. The value found by them for the equivalent of silver is 0.0011172 (evidently gram per ampere second) that of copper 0.0003292. The electric charge of a monovalent gramion is calculated to be 96,610 coulombs.—*Zeit. f. Elektrochemie,* July 11.

D'Arsonval Galvanometers.—Kuemmell.—He remarks that the weakest point of the D'Arsonval galvanometer is that the damping is generally exaggerated when the resistance of the external circuit is too small. He describes and discusses the types devisd by Carpentier, Elliot Brothers, Edelmann, Hartman & Braun, Siemens & Halske, and describes improvements made by himself. He shows that when the permanent magnet is replaced by an electromagnet the D'Arsonval galvanometer becomes a very practical and very sensitive instrument.—*Zeit. f. Elektrochemie,* July 4.

REFERENCES.

Plotting Alternating-Current Waveforms.—Blondel.—The first part of a long and well illustrated article on instruments for directly plotting down alternating or oscillating current waveforms. After a brief historical introduction, he gives the principle of the oscillograph and describes quite a number of different types of oscillographs, and discusses how to use them and how far they are correct. —*Rev. Gen. des Sc.,* July 15.

Magnetic Measurements.—Montfellier and Aliamet.—The first parts of an illustrated serial on magnetic measurements with the ballistic method.—*L'Elec.,* June 22, July 6.

Measuring Transformers.—Gallus.—An illustrated article on transformers of the French Thomson-Houston Company, to be used in connection with measuring instruments. The ratio of the two voltages is well constant over a wide range.—*L'Elec.,* June 22.

Thermostat.—Young.—An illustrated description of an electrically heated and electrically controlled thermostat.—*Jour. Am. Chem. Soc'y, El'ty,* July 24.

Telegraphy. Telephony and Signals.

Wireless Telegraphy.—Kimura.—An account of an investigation on the influence of the earth on wireless signaling. He used his "sound receiver," which indicates all variations of the current by variations of the intensity, sharpness or duration of the tone. He used five different earth contacts for the mast wire, comprising plates, cylinders and wires of various materials and dimensions. The best results were obtained with a thin cylinder put in a ground saturated with sea water. He believes that the earth connection works by its capacity rather than its conductivity, and a large earthing plate is therefore advantageous.—*Phys. Zeit.,* June 29; abstracted in Lond. *Elec.,* July 19.

REFERENCES.

Simple Time Signal Apparatus.—Kintner.—An illustrated article showing how to arrange a system of electric bells or signals to be actuated at certain specified times by the hands of a clock. The article contains all the necessary information required to enable any one to make such an apparatus.—*Am. Elec.,* Aug.

Improvements in Telephony.—Puluj.—Illustrated descriptions, taken from German patent specifications of some new improvements in telephony. He deals with the protection of telephone stations against currents in lighting, tramway and power circuits, and discusses the use of lighting, tramway and power circuits for transmitting telephone messages without danger.—*Zeit. f. Elek.,* June 9.

Miscellaneous.

Drawing Office.—Knox.—An illustrated outline of the drawing office system of the General Electric Co.—*Am. Mach.,* July 25.

Electric Heating.—Bainville.—An illustrated description of drying stoves built by Adnet for special purposes. They are heated by means of electric incandescent lamps.—*L'Elec.,* June 22.

Glasgow Exhibition.—A continuation of the well illustrated serial in which descriptions of the following exhibits are given: Stirling water-tube boiler, Duff gas producing plant, Davey, Paxman & Co.'s superheated steam plant, and 650-hp steam dynamo set, Willans-Crompton 1200-hp steam dynamo set, the Willans-Schuckert 1200-hp steam dynamo set, and the Robey-Mavor and Coulson 500-hp steam dynamo set (all these dynamos are direct-current machines), also the Berryman feed heater.—Lond. *Elec.,* July 19.

Paris Exposition.—Drouin.—An illustrated description of a 590-kilovolt amperes, three-phase generator, exhibited by Rieter of Winterthur.—*L'Elec.,* June 22.

New Books.

Induction Coils: How to Make, Use and Repair Them. By H. S. Norrie (Normal H. Schneider). Second Edition. New York: Spon & Chamberlain. 269 pages, 79 illustrations. Price, $1.

This book, comprising some 265 pages, describes the construction of numerous varieties of induction coils for disruptive discharge, medical purposes, gas engine sparks and similar matters. The induction coil is an instrument which has been within the last few years very largely improved, at least so far as high voltage disruptive coils are concerned, and with respect to such improved coils the work does not go into great detail. In this connection, therefore, it will be of more value to amateurs than to professionals, as it covers the former field quite fully. It illustrates to good advantage and gives data and dimensions of numerous types of medical coils and methods of regulation.

On the subject of contact breakers, the book is of more amateur than professional value, for it is limited to the description of a number of familiar types, and devotes a few paragraphs to the Wehnelt interrupter. The paragraph on condensers sets forth methods of construction, which have been successfully used. Following are chapters on experiments of different kinds, some of which are ingenious and calculated to display brilliant effects. A chapter on gas lighting, one on batteries for coils, and still another on Tesla and Hertz effects, concluding by one on wireless telegraphy, are among the features. These subjects are covered superficially by the work, but serve to give general ideas in brief and concise form. The work is therefore suitable for those who desire general knowledge on the subjects which it covers, and for amateur experimenters.

Independent Telephony.

At Lafayette, Ind., on July 30, the annual convention of the Indiana Mutual Telephone Association opened. Over 200 delegates were in attendance. W. C. Doolittle, of Lafayette, presided. Judge L. C. Walker, of Indianapolis, read a paper on the subject, "The Late Bell Monopoly—It Lived Unloved and Died Unmourned."

A paper was also read by George W. Beers, of Ft. Wayne, on "Independent Toll Lines." A paper was read on "Our Friends the Enemy," by George P. Haywood, city attorney of Lafayette. He was followed by C. A. Reaves, of Plymouth, who spoke on "The Co-operation of Independent Telephone Companies."

The second day's session of the Indiana Mutual Telephone Association was held on the next morning at 10 o'clock. Many new faces were to be seen among the delegates when Charles A. Zion, of Lebanon, called the meeting to order. A number of new members were admitted to the association. On motion of S. P. Sheerin, of Indianapolis, 2000 copies of the proceedings were ordered printed for general distribution. He said that he believed the organization should advertise its importance, as it was becoming a dreary factor in telephone circles. The election of officers resulted: President, L. A. Frazee, Connersville; vice-president, C. A. Zion, Lebanon (re-elected); secretary-treasurer, H. B. Gates, Indianapolis (re-elected). Mr. Frazee, on being introduced, made a clever speech of acceptance.

The second annual convention of the Independent Telephone Association of Southern Indiana was scheduled for New Albany, Ind., on Aug. 1 and 2.

A special dispatch from New Albany of Aug. 1, says: There is a large attendance at the annual convention of the Southern Indiana Independent Telephone Association, which began here at 2 o'clock this afternoon at Maennerchor Hall. Nearly every independent telephone company in the southern portion of the State is represented. Charles D. Knoefel, president of the Home Telephone Company, of New Albany, delivered the welcoming address, which was responded to by G. A. Kienle, of Huntingburg, president of the association. E. N. Coleman, secretary of the Louisville Telephone Company, delivered an address, and there were a number of papers and other discussions of subjects pertaining to the independent telephone business.

Another special dispatch of Aug. 2, says: The annual convention of the Southern Indiana Independent Telephone Association adjourned to-day, after electing the following officers: President, G. A. Kienle, Huntingburg; vice-president, C. D. Knoefler, New Albany; secretary, E. W. Pickhardt, Huntingburg; treasurer, T. M. Thom, Lamar.

Halsey Direct-Current Meter.

The type of meter illustrated herewith differs radically from those now generally in use. In fact, the only point of similarity is the vertical shaft driving the usual integrating mechanism through the medium of a worm-gear. It does not even have a commutator, but consists of a unipolar motor with mercury contacts. This meter has been developed during the last six years by Mr. Edward S. Halsey, and in the first form, patented in 1899, is shown in partial section in Fig. 1. The armature is a vertical cylinder of copper carried at its upper end by a head or spider on a shaft which holds it centrally in a cylindrical slot in a body of cement into which are molded the long pole pieces 4 and 5. These pole pieces have convex and concave faces corresponding respectively to the two walls of the slot or mercury chamber of which they form a part, defining a field that concentrates the total strength of the surrounding magnet, 1, to a small section of the cylinder or armature, which cuts the lines of force throughout nearly its entire length.

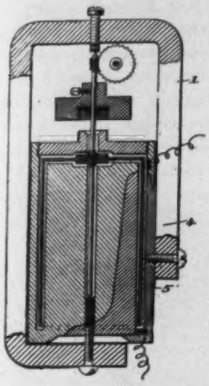


FIG. 1.—SECTION OF METER WITH CYLINDER ARMATURE.

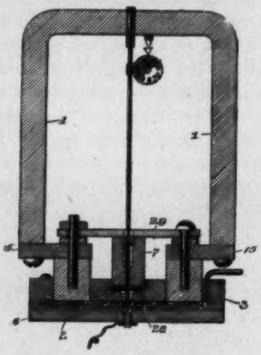


FIG. 2.—DISK ARMATURE TWO FIELDS AND IRON YOKE BASE.

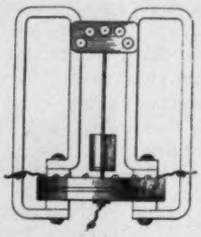


FIG. 3.—TWO MAGNETS AND FIELDS.

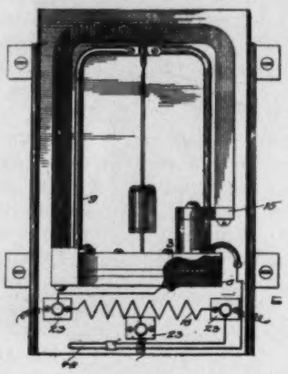


FIG. 4.—THREE-WIRE SINGLE-FIELD METER.

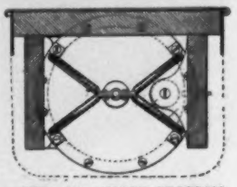


FIG. 5.—CROSS-SECTION OF FIG. 4.

FIG. 6.—MANNER OF CONNECTING THREE-WIRE METER UP.

The circular or annular slot which forms the interior cavity of the cement body is filled with mercury up and into a neck around the shaft, thus entirely submerging the armature. The current leads at the top and bottom of the slot are molded into the cement body when formed, and conduct the current to and from the armature, through the medium of the mercury, so that the current traverses the armature the entire length of the concentrated field. This construction gives a unipolar motor with a very powerful torque. At the same time, the bearing friction is practically negligible as compared with a jeweled meter on account of the absence of weight or pressure on the bearings; the floated copper armature being considerably lighter than the mercury, and the buoyancy being just compensated for by a circular ballast weight fixed on the shaft. It is stated that a 25-ampere meter will start on considerably less than 1-20 of an ampere; and that it is but 10 per cent slow on ¼ of an ampere, or 1 per cent of its full load; about 5 per cent slow on ½ ampere, 1 per cent slow on 1 ampere, and from this to full load there is not an error of over 1 per cent at any point.

The accompanying illustrations refer to various forms of mercury meters patented by Mr. Halsey. Fig. 2 is a sectional view of a form in which the armature, 2, is a plain flat copper disk enclosed in a receptacle formed of an iron bottom disk, 6, and a fibre top disk, 3, separated by a ring washer of fibre. The two pole pieces, *N* and *S*, are round studs of soft iron pressed through holes punched in the heavy fibre tops and are joined to the two poles of the magnet, 1, by means of the two soft iron stampings, 15. This figure shows the ballast weight, 7, slid down on the shaft so as to compress a soft rubber gasket, 28, cemented to it, thus sealing the meter mercury tight so that it can be inverted and transported in any position. The weight is held down by a stamped yoke, 29, which permits it to swing into place beneath an adjusting thumb nut. The rubber gasket supports the weight upon the shaft. It will be noted that the current is conducted by the leads, 13 (the center step bearing acting as one of them), so that in this case the current does not pass both fields. It might, however, be made to do so, as in Fig. 3, thus developing double the torque.

In Fig. 3 the arrangement and relation of the fields and disk armature are practically the same as in Fig. 2, but the bottom plate of the receptacle, instead of being of iron is of fibre, having two round iron studs or pole pieces through it, thus making it almost an exact counterpart to the top plate of the receptacle, the upper pole pieces coming exactly above the lower pole pieces. The two independent magnets shown maintain through their *N* and *S* pole pieces, independent fields at opposite edges of the disk armature enclosed in the mercury receptacle, so that current led to it by the positive electrode may pass through both fields in traversing the diameter of the disk and pass through out at the negative lead at the opposite side, or a portion or all of the current may pass out through the center bearing, which constitutes the neutral lead, after having passed through one field only, thereby developing but a fraction or one-half the torque and velocity, and thus being adapted to measurement of current on a three-wire system when connected into circuit as shown on Fig. 6.

Fig. 7 is from a photograph of still a different form of meter, and one which Mr. Halsey has finally adopted as being the simplest,

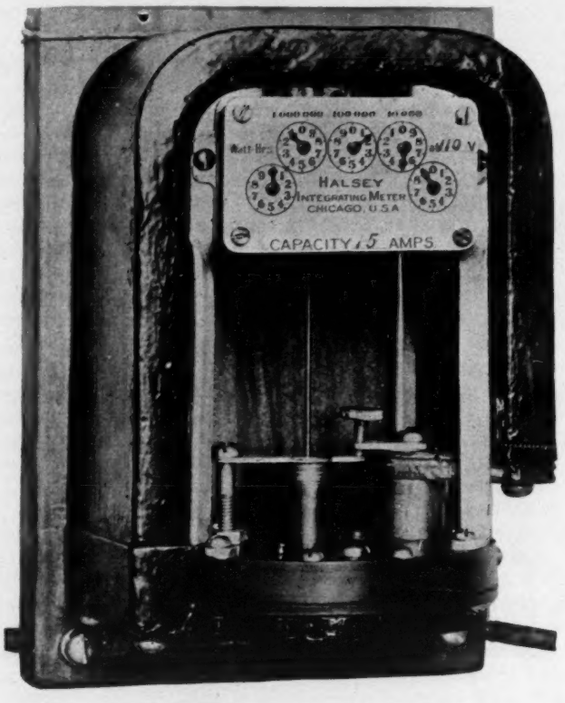


FIG. 7.

cheapest and most practical, and which is about ready for the market. Fig. 4 gives a view of this form with a fraction of the mercury chamber broken away to give an idea of the interior arrangement, and Fig. 5 is a horizontal cross-section through the line *A-A* of Fig. 4 looking down, and exposing the cross hatching of the back-board and magnet and also indicating the position of the re-

movable aluminum cover by the dotted lines. In this form the iron bottom plate, 6, has a lug the width of the magnet cast on the left-hand side and rising above the fibre top disk, 3, so as to join the *S* end of the magnet. This makes the bottom plate the south pole, while there is but one pole piece required through the fibre top, which pole piece is joined to the *N* end of the magnet through the medium of the soft iron stamping, 15.

In this meter the current traverses the disk but little over an inch, entering the bath by the upper lead and out through the bottom lead, through the iron plate. It will be seen that this armature circuit which includes the loop, 42, is shunted by the shunt, 16, so that the total current does not pass through the armature. This shunt has a third central binding post, 23, thus enabling the meter to be connected to a three-wire circuit as shown by Fig. 7. This three-wire feature, though simple, is of considerable value, as without it two motors would be required.

The frame, 9, for supporting the dial and the top bearing for the shaft consists of two aluminum wickets. The cover joints are all double-seamed together, no solder being used. When the cover is pushed back, its edges spring in between the two bead rolls, thus making a thoroughly dust and bug-proof cover without the need of felt or other packing. The lead wire openings are also dust-proof, as they dead end in the backboard.

Either a common pointer dial or a figure-counting mechanism may be used. In one of his patents Mr. Halsey covers a differential driving mechanism for the counting cylinders by which the cylinders are always driven in a forward direction by two reciprocating arms working in alternation, regardless of the direction of the rotation of the motor and worm wheel, so that no care will have to be taken as to the direction of the service to the meter. The meter is being made in sizes of 15, 30, 60 and 100 amperes, and calibrated to read in watt-hours on any constant-potential circuit from 100 to 240 volts, or in ampere-hours for arc lights and for storage battery work. The magnets of the meter consist of a steel casting made to a special formula and treated by a special process. The inventor's confidence in this magnet as well as in the meter altogether is indicated by an offer to guarantee all meter sold for three years' time against deterioration or inaccuracy. An interesting feature of this meter is the fact that the shunting or reduction of the lines of force of the field does not materially change the speed, as the same field which determines the torque acts as the magnetic brake for the meter.

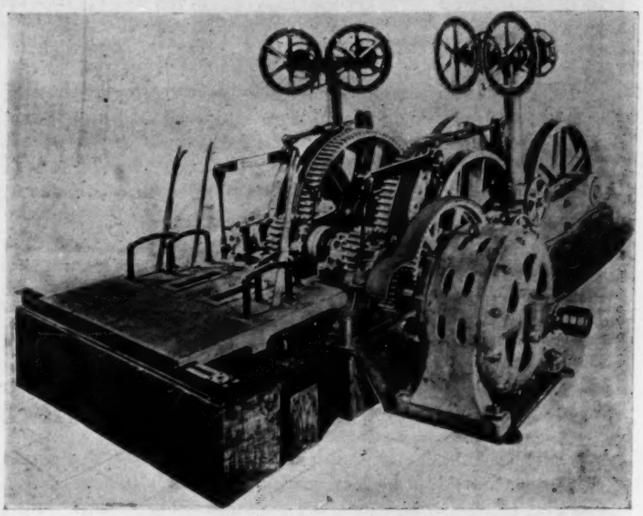
To resume, some of the points claimed for the meter are great accuracy, especially on very small loads; it cannot "run on the pressure"; it has no commutator or brushes, and no jewel, the armature being supported by mercury floatation; short circuits cannot weaken the magnet; there are no coils to burn out, so it will stand large overload; there are no continuous pressure shunt losses. There is practically no drop through the meter at full load; it is thoroughly dust and insect-proof; on account of this and the general construction, wires cannot be introduced by dishonest persons to catch and prevent the rotation of the armature. Simple and convenient means are provided for leveling, but on account of the mercury floatation, being out true does not effect the running appreciably, even on the smallest loads. It has been found that the layer of scum which forms at once on the surface of the mercury, thoroughly protects it against further oxidization or sloughing. The speed of the meter may be regulated by simply turning a lever or index finger on the bottom of the mercury chamber. It is small and compact—a 30-ampere meter being only 8½ inches high by 5½ inches wide and 4¾ inches deep.

Mine Electric Hoists on the Comstock.

About six months ago we printed a description of the Comstock Lode electrical transmission plant, and we now illustrate herewith an induction motor hoisting outfit of which four have been installed at mines on the Lode. The power for operating the mine is purchased from the Truckee River General Electric Company upon a continuous-rate basis, the amount being fixed by a peak load of two minutes' duration. As a consequence of these conditions it is desirable to secure a hoist that will operate at the highest possible efficiency. Another condition to be met was that the regulation of the general system was to be affected to as slight a degree as possible. To meet these requirements the Risdon Iron Works, of San Francisco, Calif., designed the hoist which we illustrate.

In order to secure the necessary variations in speed, the induction motor has a non-inductive resistance in both the primary and the secondary circuits, these resistances being controlled by a modified form of the ordinary street railway controller. In order that the work of the hoist shall be constant at all points in the lift, a continuous rope or balance system of hoist was adopted, the load thus being reduced to the weight of the rock alone. With an equipment of this kind the cage is started slowly and the drop in voltage is comparatively slight, being only about 7 per cent at starting.

The hoist itself consists essentially of a main driving drum and an idler around which the rope is wrapped four times in order to secure the necessary friction for lifting. From this drum the rope is carried over a head sheave, down one compartment, under a movable tail sheave back to the second compartment, over a second head sheaving and on to the driving drum. One cage is inserted between the end of the cable and the other fastened by means of heavy iron clamps, one above and one below the cage in the adjacent compartment. This simple arrangement enables the relative position of the cages to be varied at pleasure, and also permits one cage to be used in single compartment without reference to the other. The hoist



MINE HOIST ON THE COMSTOCK.

is necessarily a geered machine, the motor speed being reduced by the introduction of cut-gearing. To the main drum is attached a brake ring in connection with a heavy post brake which is set automatically by means of a heavy weight and released by hydraulic pressure. In two of the Comstock mines there are two hoists side by side and operated by one motor. One of these is intended for the vertical shaft and the other for the incline leaving the vertical at the point where the vein intersects. Double-deck cages are used in each compartment of the vertical shafts and a two-ton self-dumping cage in each compartment of the incline.

The following are data from the hoist in the Yellow Jacket Mine, which was operated for more than a month with a single cage in a compartment, which is the severest test to which the hoist can be subjected. The weight of the cage is 1200 lbs., of the car 850 lbs., and of the load 1600 lbs., or a total of 3650 lbs. The maximum rope speed was 600 ft. per minute, and the length of the vertical lift 1175 ft. The time of hoisting was 2 minutes and 10 seconds from the moment the load was started until the cage was landed at the surface. The time to accelerate the load was 8 seconds, and the power required 88.4 horse-power by wattmeter readings. The power required to lift the load is, by calculation, 66.4 horse-power, so that the efficiency of the system is about 75 per cent, the loss in the motor, transformers and all friction losses being considered. The voltage before starting was 525 and the running voltage slightly over 500. The maximum current per phase at starting was 180 amperes, the normal running current being 85 amperes. A reading taken when lifting the empty cage at 600 ft. per minute showed 48 horse-power at the wattmeter. Three of the hoists are equipped with General Electric induction motors and one with a Westinghouse motor. All four of the hoists were built by the Risdon Iron Works, of San Francisco, Calif.

Three Rivers Elevator Controller.

The operating frame of a new magnetic rheostat, made by the Three Rivers Electric Company, Three Rivers, Mich., is represented in Fig. 1, the illustration showing everything pertaining to the rheostat except the resistance coils. The diverter at the right has 34 sections, thereby eliminating all tendency to spark, even with large motors, and is very substantially made. The sections are copper insulated with mica and clamped together in a frame easily removable from the rheostat.

The compound coil diverter shown in the upper center is so arranged that the compound coils of the motor can be cut out in any number of sections up to four, and at any period of armature acceleration best suited to the motor and character of elevator it is operating. This is done by connecting to binding blocks directly back of the four small sections shown in the cut, which can be changed to any part of the segment covered by the contact arm. The shaft carrying the contact arms is mounted on ball bearings eliminating all friction, and the face of both diverters are machined perfectly true with it.

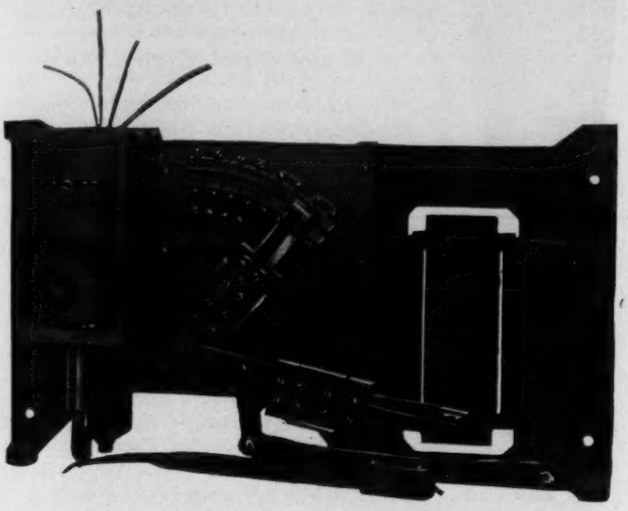


FIG. 1.—ELEVATOR CONTROLLER.

The action of the magnet can be well understood from the cut. When the first rush of current passes on and starts the elevator, the core jumps its full stroke instantly, bending the leaf spring connected with the contact arms, which follow more slowly because of the dashpot on the back of the frame. By having the magnet act in this manner it has a powerful pull, due to the momentarily heavy current, and the core reaches a position before the current can possibly decrease under any condition of load to securely overcome the spring tension during armature acceleration, after which a comparatively weak current is sufficient to hold it up.

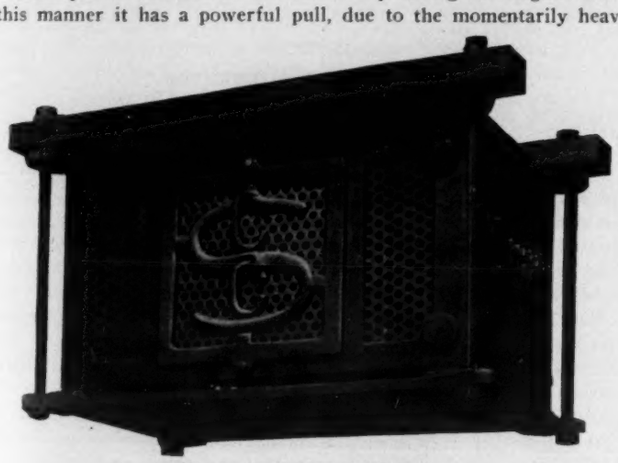


FIG. 2.—ELEVATOR RHEOSTAT.

The release and cutting in of the rheostat is so quick that no rough handling by the operator can reverse the motor on any part of a short circuit. Everything about this frame is made interchangeable and great care is taken to have all parts mechanically correct.

In Fig. 2 is shown the rheostat complete suspended from a ceiling. Since only a few wires are necessary to connect to it, it can be placed anywhere most convenient and without much regard to distance. In Fig. 3 is shown the Three Rivers elevator motor, with the reversing switch mounted on top. This arrangement is particularly suitable for direct-connected elevators, since the operating shaft is favorably located for mechanical connection to the winding machine of the elevator, but may be so placed for belted elevators and the rheostat set on the floor, hung from the ceiling or elsewhere placed to occupy room of no material value. The same company also manufacture a motor starter for double-belted elevators or other uses.

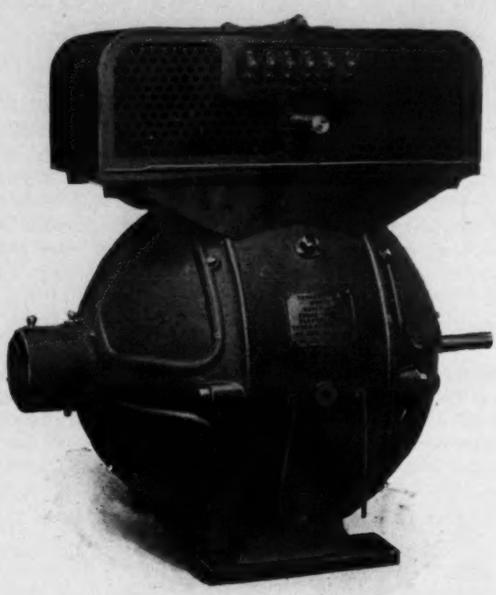


FIG. 3.—ELEVATOR MOTOR.

Improvement in Telephone Receivers.

The Hamilton (Ohio) Metal Pattern Works is introducing a novel telephone device, the invention of Frank J. Baber, of the company. The device does away with the handling of the receiver of the telephone. It is fastened to the wall on the receiver side of the telephone, and a vertical wire which is a part of the device fits over the metal holder of the receiver. It is made of heavy wire and extends from the wall far enough from the mouthpiece to reach the ear of the telephone user. At the outer end of the device is a metal clamp and a frame into which the receiver is laid horizontally, thus enabling the user to adjust it according to his height. It is so constructed that a slight pressure by the ear opens the circuit the same as when one takes the receiver down from the switch. The receiver always remains in the same position, and is ready for use at any time. By placing the ear against the receiver, the signal is imparted to the operator in the exchange in the usual manner, and when through talking the pressure of the ear is withdrawn and the connection cut out. In case one leaves the telephone to secure something or call somebody, an automatic switch keeps the apparatus from closing the circuit and cutting off the party with whom one is talking. This catch is immediately released by placing the ear in position against the receiver. The device is sold direct to telephone subscribers. About 300 of them are in use, nearly all in Cincinnati where the Bell company is reported to have given the device a good indorsement.

Holland for the Dutch.

It is stated by cable that Queen Wilhelmina has appointed a special board of naval officers, headed by Rear Admiral Tadema, to visit the United States to report on the submarine boat "Holland," with a view, it is understood ,of buying some craft of this character.

Combined Pan-American Exhibit of the Bullock and Wagner Companies.

This combined exhibit of the two companies in Electricity Building is surmounted by an electric sign which is a prominent feature in the building. The Bullock shield forms the middle, and the words "Wagner Electric" are flashed by four different colors on each side. In the background are 500 photographs showing Bullock and Wagner apparatus and installations. The Bullock Electric Manufacturing Company's part of the exhibit consists in direct-current motors and controllers, of which there are shown nine types. A 150-kw generator, designed for direct connection, and a 25-kw generator also for direct connection, are shown. The adjustment of the brushes of these two machines is operated simultaneously by a hand wheel, either in a horizontal or vertical plane. Other direct-current machines exhibited are a 30-kw belted generator, a 50-hp motor with sub-base and belt tightener, a 20-hp Bullock motor, with iron sub-base, absolutely dust-proof; a 45-hp Bullock motor, open ends without sub-base; a 10-hp dust-proof motor; a 9-hp motor, with back gear, and a 2-hp dust-proof motor on iron sub-base. All the Bullock type N motors included in the above category are built with either open or closed ends, and are adapted to be placed either on the floor, ceiling or side wall, and may be either belted or geared. The Bullock printing press controller is designed to give with the movement of one wheel all the speeds from full to an inch at a time. All these direct-current machines have brush holders of the Bullock new reaction type, which make it impossible for the brush to fly out of its seat and hit the commutator when the tension is removed.

The Wagner Electric Manufacturing Company shows three self-starting, single-phase, 60-cycle alternating-current motors, one of 30 horse-power, 208 volts; one of 5 horse-power, 104 volts, and one of 2 horse-power, 104 volts. They are automatic as to starting connections, and all that it is necessary to do is to throw in a switch to start them. A centrifugal governor changes the armature connections when a certain speed has been attained.

PAN-AMERICAN EXHIBIT OF THE BULLOCK AND WAGNER COMPANIES.

The largest of the group of Wagner transformers is a 175-kilowatt, with 18,500-volt primary and 1100-volt secondary, oil-filled and water-cooled, one of 25 built for the McCloud River Electric Power Company in Washington, for which the Bullock and Wagner companies have the entire electrical contract. In the 100-kw size a new type is shown having the air blast inlet and exhaust in the base. This is the same as 22 installed at the Castner Electrolyte Alkali Works, already illustrated and described in these pages. It has a primary wound with 14 taps and will give 28 steps in voltage variation on the secondary, from 148 to 181 volts. Transformers from 25 to 1½ kilowatts capacity are shown of the self-cooling type. All are filled with oil, except the 1½ kilowatts, which is filled with a solid insulating compound, which the company finds is a more rapid conductor of heat than an air chamber around the coils.

Four switchboard panels occupy the middle of the background. Two of these were built for the McCloud River Electric Power Company, equipped with the Wagner switchboard instruments and oil switches. The other two panels have Wagner voltmeters, ammeters and wattmeters.

Handle for Lamps.

An illustration is shown herewith of a new electric lamp handle manufactured by the Union Hardware Company, Torrington, Conn.

This handle is made of hardwood, and finished in imitation of hard rubber. As will be seen, it is a handy and convenient appliance, for which use will be found in a great many places and situations where a portable light is required.

Recent Signal Corps Work.

Reports to the War Department from the military authorities in Alaska give assurance that the various projects for greatly extending the telegraphic service in the Territory will be fully carried out during the present season. Captain William R. Abercrombie is engaged with a large force of men in constructing the proposed military road from Valdes on the southern coast to Circle City on the upper Yukon, near the boundary of the British Northwest Territory. At the same time the telegraph line is being extended along that route, and it is expected that even before the completion of the wagon road the telegraph facilities over the entire distance, from the Gulf of Alaska to the Yukon, will be in operation. While this work is going on large detachments of army isgnal corps men are extending the tlegraph along the Yukon, so that the means of communication between all the military posts in Alaska from east to west may be complete before winter sets in.

The work has advanced so far now that there is immediate need of operators for the various stations. The War Department has ordered 30 non-commissioned officers and enlisted men of the Signal Corps to report immediately to Lieutenant William Mitchell, at Seattle, Wash., whence they will join an expedition to sail within a few days for Alaska. The signal corps is also engaged in laying the military ocean cable from Shagway to Juneau, the new Territory capital. When the various projects now in progress are complete, which will be some time during the coming fall, it will be possible to telegraph from the United States by way of Canada to any important place or military post in Alaska, summer or winter.

Connecticut Corporations.

A law has just gone into effect in Connecticut that will interest new electric companies. The main difference between the Connecticut law and the statutes of the States mentioned is that the corporations which go there for their charters will, after paying the first fee for their charter, be forever free from State taxation. New Jersey derives a large annual income from the corporations which have been organized under the very liberal laws of that State, but in Connecticut the requirement is simply that the new corporation shall pay a franchise fee of 50 cents for each $1,000 of capital up to $5,000,000, and for any amount in excess of that sum, 10 cents per $1,000. Thus the cost of a charter for a corporation with a capitalization of $100,000,000 will be $2,500 for the first $5,000,000, and $9,500 for the remainder. All that is required of the organizers of a new corporation is that they shall have a "location" and an agent in some town in the State, and it is not necessary that this agent shall be a stockholder, as is required in Maine. It is not required that the annual meetings shall be held there, or that any stock shall be owned by anybody who lives in Connecticut. The provisions of the law are so minute in regard to the form of organization that it is not necessary for anybody who wants a Connecticut charter to employ a lawyer to do the business for him. All that he needs to do is to send to the Secretary of State in Hartford, for a copy of the law, and then to comply with its provisions, transcribing the by-laws for the corporation from the terms of the act.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET was brighter at its opening than at its close, for while crop conditions improved and railroad, trolley, telephone, electric light and other earnings were reported excellent, the renewal of the wrangling in the steel industry threw its gloom over all. Possibly the United States Steel Corporation and its union antagonists are fighting for vital principles, but it does strike the man in the Street—Wall—that there is a splitting of hairs while the industry and prosperity of the country suffer. But there seems to be disunion among the unionists, and from this it may be hoped that the threatened paralysis of industry may be avoided. The general weakening in quotations is indicated by the figures given below. The week was not very active. Only 625 shares of General Electric were dealt in, only 8850 Western Union, 2800 Metrpolitan Street Railway, and 8590 Brooklyn Rapid Transit. That is a narrow market, and midsummer dullness could hardly be more pronounced. Below are the market figures for the week:

NEW YORK.

	July 27.	Aug. 3.		July 27.	Aug. 3.
American Tel. & Cable...	—	—	General Carriage	—	—
American Dist. Tel.	—	—	Hudson River Tel.	120	—
Brooklyn Rapid Transit..	77	75¾	Illinois Elec. Veh. Trans.	—	—
Commercial Cable	—	—	Metropolitan Street Ry..	168	166
Electric Boat	16	17	N. E. Elec. Veh. Tran....	3	—
Electric Boat pfd.	40	44	N. Y. Elec. Veh. Tran....	11½	12
Electric Lead Reduc'n...	—	—	N. Y. & N. J. Tele.	—	—
Electric Vehicle	6	7	Tel. & Tel. Co. of Am....	4	6
Electric Vehicle pfd.	16	15	Western Union Tel.....	92¼	91½
General Electric 255		253½			

BOSTON.

	July 27.	Aug. 3.		July 27.	Aug. 3.
Am. Tel. & Tel. 161		160	Mexican Telephone	2½	—
Edison Electric Light 255		255	New England Telephone..134		133
Erie Telephone 48		—	Westinghouse Elec.	68	—
General Electric pfd. 263		—	Westinghouse Elec. pfd...	79½	79½
Cumberland Telephone ...140		—			

PHILADELPHIA.

	July 27.	Aug. 3.		July 27.	Aug. 3.
American Railways	40	40	Phila. Traction.	96	—
Electric Storage Battery..	80	80	Philadelphia Electric	5¼	5⅛
Elec. Storage Batt'y pfd.	80	80	Pa. Electric Vehicle	—	—
Elec. Co. of America....	7	7¼	Pa. Elec. Veh. pfd.	—	—

CHICAGO.

	July 27.	Aug. 3.		July 27.	Aug. 3.
Chicago Edison 176		176	National Carbon pfd.	86½	—
Chicago City Ry. 206		207	Northwest Elev. com.....	44	49
Chicago Telep. Co. 275		—	Union Traction	18	15¼
National Carbon	16½	—	Union Traction pfd.	58	58
Central Union Telephone.	45	—			

WESTINGHOUSE ELECTRIC.—The Pittsburg *Press* has the following as to the increase in the Westinghouse dividend: The long-anticipated increase in the dividend on Westinghouse Electric seconds came on Friday, and the Street was caught unawares, the brokers having had no previous knowledge that a meeting of the directors had been scheduled. When first announced from New York there was considerable skepticism, but when it was confirmed the seconds were in demand and were rushed up sharply. The new dividend rate was 1¾ per cent for the current quarter, as against 1½ per cent maintained since May, 1900. At the last call of the local board that afternoon the stock was sent to 71½, the previous record price, and an advance of 3¾ points over the close on Thursday. A reaction to 70⅞ asked followed, but yesterday there was a fair demand, and the result was an appreciation to 71½. The close was at 71⅜, or 3⅝ points higher for the week. The firsts and seconds are now on the same dividend basis and hereafter any increase from 7 per cent will be shared alike. No one doubts the ability of the company to maintain the new rate on the seconds, as earnings have been the heaviest in the history of the company and are estimated as high as 30@35 per cent. Of the other Westinghouse stocks Union Switch & Signal was a shade stronger on the belief that the stockholders will, in Setpember, get the increase in the dividend rate promised for July, but which did not materialize.

PHILADELPHIA TROLLEYS.—Reports are again current that the rapid transit franchises which recently were granted by the city to Congressman Robert H. Foederer, Jr., Contractor John M. Mack, and a number of politicians, have been turned over to the Union Traction Company. According to the rumor, the Union Traction Company pays to the holders of the new franchises $2,250,000. This payment gives the purchasers complete control of the 13 new franchises granted for Philadelphia. The first demand of the owners of the franchise was for $3,250,000, if the Broad and Diamond Street Railway franchises were found to be effective. The Union Traction Company, however, refused to give more than $1,750,000 for the franchises, excluding those for Broad and Diamond Streets. The payment of $2,250,000 would settle the whole matter, as it takes in every franchise, good, bad or indifferent. Under the new charters the Union Traction Company can acquire land by eminent domain, build overhead and underground roads, or partly overhead and partly underground roads, without going to the commission appointed under the Focht and Emery bills. The present company also can acquire a practical monopoly of every street 40 ft. and more in width for a period of seven years without laying a mile of track. There doesn't seem to be much left.

NEW YORK STATE TROLLEY SYSTEM.—An important consolidation of surface railway interests around Troy, N. Y., has been practically consummated. The company will be capitalized at $2,600,000, and will be known as the Hudson Valley Railroad Company. The roads to be merged are the Stillwater & Mechanicsville Street Railway Company, Glens Falls, Sandy Hill & Fort Edward Street Railway Company, Greenwich & Schuylerville Electric Railway, Saratoga Traction Company and Saratoga Northern Railway. The boards of directors of these companies have voted to take part in the consolidation. There are at present about 90 miles of track on the lines of the various companies, and with the completion of the work now in progress in Warren County and between Ballston and Mechanicsville there will be over a hundred miles of track. The lines connect Troy, Waterford, Mechanicsville, Stillwater, Schuylerville, Greenwich, Fort Edward, Sandy Hill, Glens Falls and Caldwell, and by the middle of September Warrensburg will be reached. Saratoga and Ballston are now connected by the Saratoga Traction Company's lines, and by fall these places and Round Lake also will be connected with the main lines. ExState Treasurer A. A. Colvin, of Glens Falls, and Joseph A. Powers, of Troy, are the principal capitalists interested in the new corporation.

WORCESTER, MASS., TROLLEYS.—The Worcester Railways & Investment Company, recently organized by Boston and Worcester men with $6,000,000 capital, to acquire the street railway properties in the vicinity of Worcester, is a voluntary association, somewhat after the manner of the Massachusetts Electric Companies. There is only one class of stock, however, which has no par value, each share representing a fractional interest in the entire assets. The shares are being privately placed at $100 per share, and it is the intention of the management to pay dividends at the rate of 5½ per cent at first, but this rate should be ultimately increased. The old Worcester Consolidated road has shown a larger relative increase in gross receipts from year to year than any other railway in the State. The companies taken over have bonds outstanding to the amount of but $1,300,000. The companies absorbed serve a population of about 250,000. Messrs. Vermilye & Co. have acted as the financial agents.

CHICAGO UNION ELEVATED.—The charter, franchise and all property of the Union Elevated Railroad Company were transferred last week to the Northwestern Elevated Railroad Company for $6,250,000, which will net $125 a share to the holders of the stock of the Union. At a meeting of the stockholders of the Northwestern Company it was voted to issue $15,000,000 of 4 per cent first mortgage convertible bonds for retiring the existing issue of $5,000,000 first mortgage bonds, due Jan. 1, 1902, a certificate of indebtedness of $750,000 and to pay for the Union property.

A LARGE DIVIDEND.—The Sixth Avenue Railroad Company, of New York City, now controlled by the Metropolitan Street Railway Company, has declared a 38 per cent real estate dividend, payable in a few days. The dividend comes from the proceeds of the sale of the company's old stable property, Sixth Avenue, Forty-third and Forty-fourth Streets, to the General Carriage Company for something like $1,000,000. The Central Realty Company has since purchased the property from the carriage company.

THE VAN CHOATE SWINDLE.—About 200 New England shareholders of the Van Choate Electric Company met last week to take measures to recover some of the $500,000 or more which they are said to have paid into the company. About $1,500 was subscribed to defray legal expenses in prosecuting their claims. The stock, which at subscription cost $10 a share, has recently sold at 10 cents a share.

MINNEAPOLIS GENERAL ELECTRIC.—The securities of the Minneapolis General Electric Company will soon be listed on the Boston Stock Exchange. There are $1,600,000 bonds, 5s and 6s; $750,000 6 per cent preferred stock, and $1,500,000 common stock. The 5s are 105 bid, the preferred 102½ and the common 30 at sales. This company has a monopoly of electric lighting in Minneapolis.

DIVIDENDS.—The New England Telephone & Telegraph Company has declared a regular quarterly dividend of 1½ per cent, payable Aug. 15. The directors of the Wilmington (Del.) & New Castle Electric Railway Company have declared a semi-annual dividend of 3 per cent, payable on Aug. 1.

INTERNATIONAL BELL TELEPHONE.—At a special meeting of the stockholders of the International Bell Telephone Company, Limited, it was voted to reduce the capital stock from $750,000, consisting of 10,000 shares of the par value of $75, to $500,000, consisting of 10,000 shares of the par value of $50 a share.

BUYING LIGHTING PLANTS.—The two new lighting plants purchased by the Electric Company of America are at Canton, Ohio, and Auburn, N. Y. The purchase price is understood to represent a cash investment of about $400,000.

Commercial Intelligence.

THE WEEK IN TRADE was, on the whole, encouraging, with good reports from many quarters. Railroad earnings for July increased 10.4 per cent over last year and 23.3 over 1899. Bank clearings at New York gained 48.8 per cent over last year and 11.4 over 1899, while at leading cities outside of New York the gain is 13.3 per cent over last year and 8.5 over 1899. Prices of commodities are firm. There is little or no alarm as to bad crops, wheat being at its best and corn improving all the time. The steel strike was supposed to be off, but is "on agin," with a muttered curse from everybody. That it can last long is not believed in any quarter, and public opinion seems to be dead against it. Greater activity prevails in Western markets in iron and steel than in the East, but nowhere is activity very pronounced. Healthy conditions are indicated by a rather remarkable demand for all kinds of steel entering into implement, vehicle and like work. A rather general marking up of prices on finished material is regarded as a strong probability, for the present week, and the course prices may take will be determined by the amount of ordering for autumn delivery. Electrical trade in all lines is good, and the inquiries for new plants is far in advance of what is usual at this season.

EXPORTS OF ELECTRICAL MATERIAL.—The following are the exports of electrical material from the port of New York for the week ended Aug. 1: Antwerp—4 cases electros, $47; 26 cases electrical material, $1,973; 2 crates auto vehicles, $2,000; 210 packages electrical machinery, $16,568. Argentine Republic—67 cases electrical machinery, $5,307; 58 cases electrical material, $1,755. Azores—1 case electrical material, $25. British Possessions in Africa—135 cases electrical material, $10,511; 5 packages electrical machinery, $172. Brazil—46 cases electrical material, $693. Barcelona—93 packages electrical material, $8,221. British East Indies—12 packages electrical material, $968. British Australia—1 case electrical material, $20; 1 case electric machinery, $35. Berlin—27 packages electrical material, $448. Bordeaux—54 packages electrical material, $2,487. British West Indies—11 packages electrical material $103. Central America—4 cases electrical material, $780. Chili—50 packages electrical material, $1,776. Cuba—82 cases electrical material, $2,113; 8 cases electrical machinery, $265. Ecuador—7 packages electrical material, $170. French West Indies—3 cases electrical material, $11. Gimon—5 packages electrical material, $73. Genoa—12 packages electrical material, $553. Glasgow—3 packages electrical machinery, $918. Hamburg—17 packages electrical material, $298. Havre—5 cases electrical machinery, $199; 13 packages electrical machinery, $337. Hong Kong—3 packages electrical material, $326. Japan—26 packages electrical material, $1,080. London—185 packages electrical machinery, $7,328; 145 packages electrical material, $8,676; 24 packages motor vehicles, $19,800. Liverpool—116 packages electrical machinery, $7,686. Marseilles—20 cases electrical machinery, $706. Mexico—2 packages electrical material, $444; 127 packages electrical material, $2,558. Manchester—1 package electrical material, $200; 4 cases electrical machinery, $2,500. Malta—3 packages electrical machinery, $35. Milan—3 packages electrical material, $169. New Castle—47 cases electrical machinery, $5,900. Newfoundland—13 packages electrical material, $229. Naples—4 packages electrical material, $366. Novia Scotia—2 packages electrical material, $25. Peru—12 packages electrical material, $690. Philippines—3 packages electrical material, $108. San Domingo—30 packages electrical material, $30. St. Petersburg—2 cases electrical machinery, $200. Southampton—8 packages electrical material, $316. Trieste—11 cases electrical material, $754. U. S. Colombia—10 packages electrical material, $81. Vienna—2 cases electrical material, $144. Venezuela—31 packages electrical material, $317.

TELEPHONY IN PENNSYLVANIA.—The change in the name of the Schuylkill Valley Telephone Company to the Consolidated Telephone Companies, and the increase in capital from $400,000 to $4,000,000, and in the debt from $400,000 to $6,000,000, are incident to the combination of the independent local and the long-distance systems of Pennsylvania, announced by us in July. The systems to be included and their capital are as follows: Interstate Telephone & Telegraph, of Pennsylvania, capital $2,000,000; Standard, of Bucks County, $100,000 (bonds), $100,000; Lehigh, or Allentown, $150,000 (bonds), $150,000; Anthracite, of Hazelton, $100,000; People's, of Wilkesbarre, $300,000 (bonds), $300,000; Lackawanna, of Scranton, $450,000 (bonds), $450,000; Carbondale, of Carbondale, $100,000; Overland, of Leheighton, $50,000; total stock, $3,250,000; total bonds, $1,000,000. The Keystone Telephone Company, capital $10,000,000, covering Philadelphia proper, and the Keystone State Telephone Company, having as its territory the outlying towns, such as Chester and Jenkintown, will have a close working agreement with the Consolidated companies. Both the Consolidated and the Keystone companies will have a traffic agreement with the Interstate Company, of New Jersey, and with the Telephone, Telegraph & Cable Company, of New York and Boston.

FIVE HUNDRED-KW GENERATORS DRIVEN BY GAS ENGINES.—The Sprague Electric Company has recently closed an interesting order for three Lundell split-pole 500-kw engine type generators, with speed of 100 r. p. m., and wound for 250 volts, to be direct connected to gas engines. These three generators will be installed in the new works of the Lackawanna Iron & Steel Company, at Buffalo, and are designed for a continuous overload of 25 per cent at a high efficiency. The gas engines will utilize as fuel waste gas from the coke ovens of the Lackawanna Company. These will be among the largest generators in this country ever operated by direct-connected gas engines, and the method of utilizing waste gases for such large amounts of power has never before been attempted, we believe, in the United States. The Sprague Electric Company has been very successful with the split-pole machines.

CUMBERLAND TELEPHONE & TELEGRAPH COMPANY.—The Boston Stock Exchange has listed 62,376 shares of the Cumberland Telephone & Telegraph Company, of an authorized issue of 100,000 shares. The company is a consolidation of the Cumberland Telephone & Telegraph Company, the Great Southern Telephone & Telegraph Company, and the Ohio Valley Telephone Company. The company has regularly paid dividends upon its stock from Sept. 22, 1883, the total amount so paid being $1,853,203, the last three dividends being at the quarterly rate of 1¾ per cent. The directors are the following: James E. Caldwell, Henry Sperry, W. H. Woolverton, E. M. Barton, V. E. Shwab, F. O. Watts, W. W. Berry, William Litterer, George R. Knox, M. J. Smith, A. G. Sharp, Alexander Cochrane.

FURTHER AMERICAN EQUIPMENT FOR SYDNEY TRAMWAYS.—John A. Mead & Co., of 11 Greenwich Street, New York City, whose works are at Rutland, Vt., have just been awarded a contract, through the Babcock & Wilcox Company, for the supply of a complete coal and ash conveying plant, which will be installed in the new central generating station of the Sydney City & Suburban Tramways, Sydney, New South Wales. The machinery, valued at about $15,000, will be capable of handling 45 tons of coal, etc., per hour. Shipment is to be made by Dec. 1. The Babcock & Wilcox Company is to furnish the boiler equipment, aggregating 4500 horsepower, for the Sydney power house. The boilers will be built at the Glasgow (Scotland) plant of the company.

A LARGE SOUTHERN CONTRACT.—The water power on the Catawba River at Rhodhise, N. C., is one of the largest in the United States, and will be utilized for cotton manufacturing and other industries. The S. Morgan Smith Company, of York, Pa., recently shipped to the Rhodhise Manufacturing Company two pairs of 36-inch and one single 30-inch McCormick turbines, mounted in iron cases, with the necessary supply pipes, draught tubes, a complete rope drive, as well as head shafts, couplings, bearings and a 1000-gallon fire-pump.

WESTINGHOUSE GROWTH.—Deeds have been recently recorded in Pittsburg, transferring to the Security Investment Company (a subsidiary Westinghouse concern) 220 acres of land at Cavettsville, North Huntingdon township, Westmoreland County, Pa., and 319 acres in Westmoreland and Allegheny counties. It is reported in Greensburg that the Westinghouse Company will erect buildings.

S. B. CONDIT, JR., & CO., 63 Oliver Street, Boston, have been awarded the contract for a six-panel high-tension switchboard for the power plant at Garvins Falls, Bow, N. H. This board will be equipped with Elden oil-type circuit breakers and switches. Some of the circuit breakers will handle 1300 volts.

TELEPHONE SWITCHBOARD FOR AFRICA.—The Clark Automatic Telephone Switchboard Company, of Providence, R. I., has shipped to Cape Town, South Africa, for the Cape Government railway service, a 12-point Clark switchboard.

THE SOLAR CARBON COMPANY, of Ravenna, last week shipped a carload of 6000 batteries to a supply house in Wisconsin, completing an order for five carloads for the same people.

THE WORLD'S COPPER PRODUCTION.—The latest statistics show that the copper production of the world during the last century was:

Country.	Tons.
United States	2,725,600
Chili, Bolivia, Peru	1,870,700
Spain and Portugal	1,189,700
England	855,800
Germany, Sweden, Norway	661,600
Australia	443,800
Japan	292,600
Other countries	860,400
Total	8,100,200

During a single year three mines produced about 28 per cent of the total output, viz., Anaconda, 47,830 tons; Calumet and Hecla, 41,101; Rio Tinto, 33,705. If the product of five other mines be added, the output amounts to 50 per cent, a full half of the world's production. These five mines are Boston and Montana, 27,700; United Verde, 18,900; Mansfield, 18,045; Copper Queen, 15,066; Tharsis, 12,000. It would be very interesting to know how much of the 8,000,000 tons went into electrical work. Can any one hazard an approximate guess?

APPARATUS FOR AUSTRALIA.—George McInnes, P. O. box 2127, Marshall Square, Johannesburg, South Africa, mechanical and electrical engineer, writes to the National Association of Manufacturers, Philadelphia, that he has been established since 1892, and he would now like to hear from American firms which would feel interested in quoting him prices and furnishing particulars regarding boilers, 10 to 100 brake, or actual horse-power, from 100 to 150 lbs. working pressure, and suitable for small lighting plants in basements, etc.; engines, 10 to 100 brake horse-power, up to 25 brake horse-power, in single engines of medium speed, from 25 to 100 brake horse-power in compound engines of medium and high speed. Governors must be of best known types. Dynamos, continuous current, 110 and 220 volts, 50 to 500 amperes; generators, three-phase, 2000 and 3000 volts, 10 to 80 horse-power; motors, continuous and three-phase, 1 to 50 horse-power; transformers, three-phase, primary 2000 and 3000 volts, secondary 100 and 200 volts. Prices, including the cost of packing, should be quoted f. o. b., New York. Terms of payment would be cash against shipping documents in New York City.

VARIOUS DOMESTIC ORDERS FOR COAL PLANTS.—John A. Mead & Co., of New York City, have obtained an order for the installation of coal and ash handling machinery in the packing house works of Kingan & Co., Indianapolis. The Kingan power plant is being considerably extended, additional B. & W. boilers being put in, and a contract has been allotted to the American Stoker Company for the supply of a number of automatic stoking equipments. Other contracts secured within the last few days by the Mead people comprise a coal and ash conveying outfit, including scales, etc., for the power station at North Second and Salisbury Streets, St. Louis, of the St. Louis Transit Company. This is the third contract received from the same source, and is valued at upwards of $35,000; an $8,000 coal and ash conveying equipment for the Cleveland City Railway, and machinery of a like description having an hourly capacity for handling 45 tons, for erection in the main plant of the Denver Tramway Power Company. The value of the latter order is said to be nearly $6,000.

MANHATTAN POWER PLANT.—The Manhattan Railway Company has filed with the New York Department of Buildings plans for the electric power house sub-stations for its Sixth and Ninth Avenue elevated lines. There will be three sub-stations and one repair shop, and the combined cost of these will be $133,000. The sub-stations are to be used to transform the electric current generated at the company's main power house at Seventy-fourth Street and the East River. The new buildings will be situated as follows: A four-story brick sub-station at 173 to 175 Spring Street, a four-story brick sub-station at 354 to 356 West Fifty-third Street, a two and three-story brick sub-station on the north side of 110th Street, near Manhattan Avenue, where the Ninth and Sixth Avenue lines make the curve from Columbus into Eighth Avenue, and opposite Morningside Park; a two-story brick repair shop at 118th Street and Lafontaine Avenue. The east side sub-stations are fast nearing completion.

POWER PLANT NEAR MINNEAPOLIS.—The Twin City Rapid Transit Company, which obtained authority from Congress at its last session to dam the Mississippi River at Koon's Rapids above Minneapolis and develop power, has begun work on the actual construction of the dam, the preliminary work of taking soundings having been completed. This franchise is entirely distinct from the franchises owned by the company for operating street railways at Minneapolis and St. Paul. It gives to the Twin City Company control of all available water powers around the two cities, as the company already has control of the Falls of St. Anthony, at Minneapolis. It is estimated that the cost of the new dam will be $600,000, and that a minimum of 10,000 horse-power can be developed at the rapids.

CONTRACT FOR WOODEN CONDUIT.—One of the largest contracts for wood pipe that has ever been let in the Northwest has been closed between the Seattle Automatic Telephone Exchange Company and the J. A. Soderberg Company, 410-411 Washington Building, this city. The pipe will be used for conduits for underground wires for the new telephone system being established in this city. The contract calls for 300,000 ft. (or, approximately, 57 miles) of pipe within 100 days. The pipe will be three inches in diameter, and will be in sections running from 6 to 12 ft. in length. It is to be made from Washington fir, and will be wrapped with 20-gauge galvanized annealed wire.

SHASTA POWER.—The Shasta Electric Light & Power Company, of Redding, Calif., will develop 4750 horse-power on the McCloud River, in Shasta County, Calif. The water will be diverted from the river by suitable headworks and carried for a distance of two miles in a flume having a capacity of 1000 cubic feet per second. The effective head on the wheels is 56 ft. Four turbine and generator units will be installed. The transmission lines will aggregate 110 miles in length. The bulk of the current will be consumed by the mines and smelters now operating in Shasta County. The work is being pushed as rapidly as possible, so that the first delivery of current will be made in December of this year.

BRASS CONSOLIDATION.—The Chicago Brass Works have recently been acquired by the Coe Brass Company, of Torrington, Conn., and the American Brass Company, fast absorbing the successful brass companies of the United States, has now taken in the Holmes, Booth & Haydens Company, of Waterbury, Conn., of which Thomas B. Kent, of New York, is president and general manager, and the ownership of which is practically in the hands of the Kents and Havemeyers and Burnhams, of New York. Holmes, Booth & Haydens were once quite conspicuous in the electrical field, and were the school for several well-known electrical men.

PLANT FOR CASTINGS WORKS.—The Northern Electric Manufacturing Company has a contract for apparatus for a new plant of the American Malleable Casting Company, at Chicago Highlands, Ill. The plant will be operated by electric power throughout, furnished by three 50-hp gasoline engines built by the Maywood Foundry & Machinery Company, of Maywood, Ill. Each engine will be attached directly to a 40-kw Northern Electric generator. Motors will be scattered around the works, which will have a capacity of 20,000 tons a year.

SPOKANE RIVER POWER.—The Northwestern Mammoth Granite & Electric Power Company, C. M. Allen, secretary, intends to develop some 10,000 horse-power on the Spokane River, 9 miles from Spokane, Wash. The power will be used to operate a 16-mile electric road, granite quarries, saw mills, etc. The company have 20,000,000 ft. of standing lumber and 1000 acres of high-grade granite. The capital is $100,000. It is proposed to bond the road for $250,000 in order to build and equip the dam, power house, etc.

PLANT FOR ENGLISH WESTINGHOUSE.—Jones & Laughlins, Limited, of the American Iron & Steel Works, Pittsburg, have received an order from the British Westinghouse Electric Company, for the power transmission for the new shops at Birmingham, England, for which a large amount of American material has already been ordered. The order includes cold rolled shafting, pulleys and hangers, and was secured in keen competition with English and German makers. Additional contracts of this kind will be given out.

BRICK INSTEAD OF STEEL.—As a result of the steel strike the Kansas City Electric Light Company has decided to use brick instead of steel for the stacks of its new $750,000 power-house, ground for which is to be broken in 10 days. There are to be two of these chimneys, each to be 243 ft. high. Brick from Germany will be used. It is also said that some of the railroad companies are going to put up brick bridges instead of steel.

TOKYO STREET RAILWAYS.—Representatives of the Tokyo, Japan, consolidated street railways have been in the United States for some time, making some investigations of electric railway apparatus previous to placing an order for three 1200-kw generators and several hundred motor equipments. The matter is momently expected to reach a decision by cable.

SOUTH AFRICAN TRAMWAYS.—Mr. J. E. Lloyd, manager of the Capetown electric traction system, is said to be at present purchasing quantities of electrical and miscellaneous supplies, etc., in this market. The Morris Electric Company, of New York City, have so far received orders for 5000 incandescent lamps (16 candle-power), 100 dozen oil headlights, 100 chimneys, etc.

ELECTRIC HEATERS.—The Manhattan Elevated, of New York, has awarded a contract to the Consolidated Car Heating Company to equip 1200 cars with apparatus for electric heating. Three hundred cars will be ready by Jan. 1, 1902.

PINIONS FOR BRAZIL.—The New Process Raw Hide Company, Syracuse, N. Y., has just made a shipment of 24 pinions to the Sao Paulo Light & Traction Company, of Sao Paulo, Brazil.

General News.

THE TELEPHONE.

OPELIKA, ALA.—The Opelika telephone exchange is being remodeled and the work is nearing completion. All the wires have been placed in cables.

SAN FRANCISCO, CALIF.—A private exchange system will soon be in operation in the Custom House and Appraiser's building. There will be connections with twenty-eight federal offices.

LOS ANGELES, CALIF.—Improved telegraph communication between the Pacific Coast and the East is a matter of the near future, which has been given official assurance. To meet the demand for better service it is announced that two new copper wires will be in service between San Francisco and Chicago, via the Santa Fe route, by Aug. 15, one to be used exclusively by the Western Union Company and the other by the railroad. The latter, however, will be available for commercial work when business calls for extra service.

WILMINGTON, DEL.—The N. Y. P. & N. Telegraph Company have completed their wires through the entire peninsula, and made connections with the Postal Telegraph Company in Wilmington. Offices in Delaware have been opened as follows: Smyrna, Dover, Harington, Bridgeville, Seaford and Laurel.

TUNBRIDGE WELLS, ENG.—The National Telephone Company, of Tunbridge Wells, England, has announced its intention of giving "an unlimited service for a penny a day" (two cents) to its subscribers in that town.

ROME, GA.—The City Council has passed a resolution instructing the fire committee to make certain improvements in the fire alarm system. New batteries, boxes and wires will, it is stated, be placed in position at once.

BOISE CITY, IDAHO.—Certificate of the increase of the capital stock of the Idaho Independent Telephone Company from $100,000 to $500,000 has been filed, and is made for the purpose of extending the company's lines.

TYNDALL, IA.—The new telephone line between Tyndall and Tabor and Bonhomme is completed. Bonhomme will be much benefited owing to the fact that the town is off the railroad.

MT. PLEASANT, IA.—This city will soon have the new Olds telephone line connections. The line is being built south through Swedesburg and a couple of miles south of Swedesburg a spur is being put up to Trenton.

CANTON, ILL.—The Central Union Telephone Company is engaged in installing a new office at Canton.

BLUFFS, ILL.—The Illinois Telephone Company has had its capital stock increased from $25,000 to $100,000.

ASTORIA, ILL.—The Central Union Telephone Co. will this fall put in cables owing to the increased business requiring so many wires.

LA SALLE, ILL.—The City Council has ordered the Central Union Telephone Company to remove its poles and other belongings within thirty days.

SALINA, ILL.—The telephone company has established toll stations at Salina and Circleville. Construction work is active also on other parts of the system.

CHICAGO, ILL.—The Chicago Telephone Company is now installing slot machine telephones in the twenty police stations supplied with public telephones.

DECATUR, ILL.—The Macon County Telephone Company, instead of using plain galvanized iron wire, has determined to use weatherproof iron wire for its circuits. Copper is better yet.

LAKE FOREST, ILL.—The Telephone Company are putting in a new switchboard at their office here, and when completed will equip each patron with a long distance metallic circuit set.

OTTAWA, ILL.—From an exchange of a few more than 200 telephones a few months ago, the Ottawa exchange of the Central Union Telephone Company has jumped to over 800 telephones.

MT. CARROLL, ILL.—Frank Zinnel, proprietor of the Independent Telephone Company, has transferred a lot of poles and wire to Sabula and is ready to put in an exchange at that place. Mr. Zinnel has hopes of extending his line to Cedar Rapids.

OAK PARK, ILL.—Work on a $15,000 building to be erected in North Boulevard, near Wisconsin avenue, by the Chicago Telephone Company, has been begun. It will be built of brick and stone, and will be used as an exchange office for Oak Park, Harlem, River Forest and Maywood.

FARMER CITY, ILL.—The Farm & City Telephone Company, of Farmer City, have held their first meeting under the new organization since its incorporation. The new company is incorporated for $50,000. B. F. Wasson was elected president; S. W. Clay, of Atlanta, secretary, and L. B. Wasson treasurer.

POLO, ILL.—Farmers living between Polo and Hazlehurst and in that vicinity will soon have telephone service. The County Telephone Company, of Polo, which last spring organized with a capital stock of $20,000, has been industriously at work. Six hundred feet of cable has been put in the city of Polo to connect with the switchboard at the central office, which is located over the Chaddock store. The new switchboard has a 200 drop capacity.

CHICAGO, ILL.—Corporation Counsel Walker, in an opinion to Freeman K. Blake, chairman of the sub-committee of the judiciary committee of the Council, has held that "improved service" by the addition of a copper metallic circuit would afford no excuse in law to the action of the Chicago Telephone Company for charging $175 a year for a telephone when the maximum rate fixed by ordinance was $125 for business houses and $100 for a residence.

PARKER CITY, IND.—The Parker Telephone Company, Randolph County, has been incorporated with a capital stock of $2,500.

SOUTHPORT, IND.—The Central Union Telephone Company has about completed the putting in of an exchange and thirty private telephones in Southport and the vicinity.

LYNN, IND.—The Lynn Local Telephone Company, with a capital stock of $2,400, has just started. The system is Stromberg-Carlson, with 100 switchboard capacity. The circuits are of Roebling wire. S. C. Bowen is president, D. Hecker treasurer and W. E. Hinshaw secretary.

WABASH, IND.—The telephone line of the Strauss telephone system, which covers all Northern Indiana, was completed from Warsaw to this city on July 25. This fills in a gap that has existed for a year or more, and renders possible long distance communication from Indianapolis to the Northern State line by the independent direct line.

INDIANAPOLIS, IND.—Two new telephone companies have been incorporated by filing articles with the Secretary of State, the Paoli, Unionville & English Telephone Company, and the Clermont Telephone Company. The former is a modest concern with a capital of $1,000. The stockholders are numerous, however. The latter is more pretentious and has a capital of $10,000. B. F. Long heads the board of directors.

TOPEKA, KAN.—A competitive telephone system has been spoken of here, but the idea is not favorably received.

FRANKFORT, KY.—Articles of incorporation have been filed by the Jackson & Hazard Telephone Company, with a capital stock of $2,025.

YAZOO CITY, LA.—A new telephone line running from Yazoo City to Milestone, passing through Eden, Blake and Thornton, has been completed and connection made with the Mutual Company.

WEST PARIS, MAINE.—The Eastern Telephone Company has been granted the right to set its poles in Lewiston, and the line will soon be extended to this village. It will connect with the local wires in Paris, Sumner, Woodstock and Greenwood.

PORTLAND, MAINE.—The following officers have been elected by the New England Automatic Telephone Company. President and general manager, Lewis A. Goudy, of Portland; vice-president, William G. Nash, of Boston; clerk, Oscar H. Hersey, of Portland.

KINEO, MOOSEHEAD LAKE, MAINE.—The Moosehead Telephone & Telegraph Company has closed a contract with the New England Telephone & Telegraph Company, who will extend their line from Monson to Greenville, and the Moosehead company will build to Greenville from Kineo, via Spencer and Lily Bay.

BALTIMORE, MD.—By contract with the War Department the Maryland Telephone & Telegraph Company will shortly begin the construction of a line to establish telephone service between Forts Howard, Armistead and McHenry in the harbor entrance to Baltimore and all points served by the company's lines.

BALTIMORE, MD.—The Enterprise Telephone Company's lines in Montgomery and Prince George's counties are to be extended and to have connection with the Chesapeake & Potomac's long-distance lines. Long-distance transmitters will be placed on all of the former company's stations, including those in private residences.

WALKERVILLE, MICH.—The Lake Erie & Detroit River Railroad is laying a new telegraph line between Walkerville and St. Thomas.

DETROIT, MICH.—The Oakland County Telephone Company has been obliged to substitute cables in the place of bare wires in the alleys in the business portion of the town. Within the past four months 100 subscribers have been added to the list and there is constant demand for more telephones. The list has now almost reached the 500 mark.

LUDINGTON, MICH.—The Pere Marquette Telephone Company has been formed; capital, $30,000.

MANKATO, MINN.—The Mankato Citizens' Telephone Company have the toll line completed to Garden City township.

FLEMING, MO.—Telephone connections now exist between Fleming and Orrick.

PLATTSBURG, MO.—The Plattsburg Telephone Company, of Plattsburg, capital stock $10,000, has been incorporated by J. C. Atchison, F. R. Allen, E. E. Bowlin and others.

KANSAS CITY, MO.—A. H. Stoner, representing the Gamewell Electric Company, of Chicago, has made a proposition to the board of police commissioners to put in a police signal system to become the property of the city at the end of ten years. The proposition requires the payment of $10,000 cash, and a monthly rental of $6.40 per box for 120 months. The system will consist of 130 boxes, embracing all the police stations. The aggregate cost of the system will amount to about $87,000.

PAPILLION, NEB.—A local company has undertaken to supply Papillion with telephone service.

WINSTON, N. C.—The American Bell Telephone Company has about completed a twenty-eight-mile, long distance line, from Winston to Greensboro, N. C., where connection will be made with the main line of the company.

WALHALLA, N. D.—Langdon's local telephone line has been put in operation.

GRAND FORKS, N. D.—Work has commenced on building the underground telephone conduits, and under favorable conditions they may be completed in six months.

SYKESTON, N. D.—M. McConnell has taken a large crew of linemen out on the Bowden extension of the Northern Pacific, out of Sykeston, and will erect the new telegraph lines along the branch.

GRAND FORKS, N. D.—The Northwestern Telephone Company has commenced excavating preparatory to the erection of a two-story building. A crew of men has also been digging a trench for conduits for an underground service. The company will expend upwards of $25,000 before the ground freezes.

WOODSVILLE, N. H.—The Woodsville Telegraph Company has extended its lines to Lisbon.

SILVER CITY, N. M.—The Grant County Telephone Company now has a direct wire to Santa Rita, which greatly facilitates the transaction of business between that camp and Silver City. The company has 115 telephones in use on its system and is daily adding to the number.

TRENTON, N. J.—The Inter-State Telephone Company has filed with the Secretary of State a certificate increasing its capital stock from $100,000 to $5,000,000. The company has already acquired all the important telephone lines in New Jersey not already controlled by the Bell system, with the exception of two. These are the Eastern Company at Camden and the Independent Company at Atlantic City. Negotiations are already under way for the acquisition of these.

KANONA, N. Y.—The South Howard & Kanona Telephone Company, of Kanona, has been formed; capital, $220. Directors: Edward Stewart, Frank Conine and J. C. Barton, Bath.

ROCHESTER, N. Y.—The Rochester Home Telephone Company is at Mendon Center constructing a through line, direct from Rochester to Honeoye Falls. Connections will also be made with Mendon and Mendon Center.

TROY, N. Y.—Workmen have begun laying the conduits for the Troy Telephone & Telegraph Company. Superintendent Nicholson, who is in charge of the work, states that it will probably be a year before wires are run through the conduits.

FAYETTE, O.—The system of the Fayette Telephone Company was thrown entirely out of service by a severe wind and thunder storm a few days ago.

NAPOLEON, O.—The Napoleon Home Telephone Company, of Napoleon, O., is rebuilding its plant, putting in the latest and most modern equipment.

XENIA, O.—The Citizen's Telephone Company, of this place, has secured a good list of subscribers and will install a branch exchange at Yellow Springs.

AKRON, O.—The Akron People's Telephone Company is issuing a new directory, including Barberton and Cuyahoga Falls. The company has 2,400 telephones.

CHESTER, O.—Both the Columbiana County Telephone Company and the Central District & Printing Telegraph Company (Bell) have franchise applications pending before the Council.

BOWLING GREEN, O.—Stockholders of the Bowling Green Telephone Company have elected officers as follows: L. Black, president; J. B. Hickox, secretary; W. R. Brakwell, manager.

FREMONT, O.—The Fremont Home Telephone Company has declared a regular quarterly dividend of 1½ per cent. It has about 600 telephones in operation and the business is growing.

HILLSBORO, O.—The Central Union Telephone Company, of Hillsboro, O., has raised its rates in Clinton County to $1 per month for residences and $1.50 for business telephones with ten on a line.

TOLEDO, O.—Mr. F. M. Wartenbe, who recently resigned the position of manager of the C. U. Telephone Co., will locate in Toledo, where he expects to remain in the employ of the same company.

CINCINNATI, O.—Philip Fitzsimmons, by Probate Court declaration, has announced that he has conveyed to the Fitzsimmons Telephone Manufacturing Company all his rights to use the streets and alleys of the city for telephone purposes.

SPRINGFIELD, O.—Despite the fact the Springfield Home Telephone Company has secured a franchise from the Council, the Springfield Citizens' Telephone Company, which is headed by Philip Hounker, is still endeavoring to secure a franchise from the Probate Court.

ST. PARIS, O.—The St. Paris Telephone Company has declared a semi-annual dividend of 5 per cent. Extensive improvements to the system have been decided upon and will be made in the near future. The company intends to connect Rosewood, Carvesville, Millertown, Christianburg and a number of surrounding towns.

COLUMBUS, O.—The Central Union Telephone Company (Bell) at this point has announced a 20 per cent. increase in the salaries of all its operators and has reduced the working day to nine hours. About 100 girls are affected, and it is said that the same advance will be granted in other places where the company has exchanges.

PIQUA, O.—The right of way has been secured and the work of grading is now going on between Piqua and Minster by the Miami Valley Electric Railway Company. After this branch of road is completed they will secure the right of way west of Minster to Maria Stein and St. Roas, then back along the bank of the St. Mary's reservoir to Celina.

MILLERSBURG, O.—The Killbuck Telephone Company is making a second attempt to secure a local franchise despite the fact the Millersburg, Wooster & Orrville Telephone Company, an independent company, is giving satisfactory service. It offers lower rates than the latter company, and it is claimed that it is attempting to secure a franchise which will be turned over to the Bell company, which has no local exchange.

CINCINNATI, O.—The City & Suburban Telegraph Association of Cincinnati, which controls all the telephone properties in that city and the cities of Hamilton, O., and those across the river in Kenton and Campbell counties, Ky., has arranged to establish a complete branch exchange in the Exposition buildings at the Second Fall Festival, which opens at Cincinnati Sept. 16. The idea will be to demonstrate to the public the workings of a complete exchange of the common battery system. It will be connected up with the city and all long distance instruments.

FINDLAY, O.—The plant of the Findlay Home Telephone Company, which has just been completed, was formally turned over to the company a few days ago by the North Electric Company, who installed it. The plant was inspected by C. H. Ledlie, of St. Louis, who pronounced it to be one of the finest plants of the size in the country. The company has appointed as general manager of its business Mr. A. C. Morse, formerly with the Federal Telephone Company as a district superintendent. The new system is controlled by the Federal Telephone Company.

GUTHRIE, OKLA.—The Topeka & El Reno Telephone Company was chartered July 27. The capital stock is $10,000. Directors: W. F. Evans, Topeka, Kan; H. B. Low, Fort Worth, Tex.; F. H. Wright, G. W. Bellamy and O. O. Blake, of El Reno.

OSAGE, OKLA.—The Osage & Eastern Oklahoma Telephone Company, with County Treasurer J. H. Clapp president, has just been notified by the Interior Department at Washington that it has been granted a permit to erect, establish and maintain a telephone system in the Osage reservation.

KINGSTON, ONT.—The Bell Telephone Company is making arrangements to try an experiment with the Marconi system of wireless telegraphy in the city of Kingston, Ont. One of the instruments will be placed on Garden Island and the other in Kingston.

FLORENCE, ORE.—A contract has been awarded to H. H. Fish to build a telephone line from Florence to Acme. The line may soon be extended to Mapleton and Eugene.

MARK CITY, PA.—The Bell Telephone Company has established communication with Gettysburg. The new line is now open for business.

SILVERDALE, PA.—The Borough Council has granted the Standard Telephone Company the privilege of erecting poles through the town.

YORK, PA.—The Highland Telephone Company, which system embraces the Delta franchises, has declared a dividend of 3 per cent for the past six months.

WILLIAMSPORT, PA.—The directors of the Central Pennsylvania Telephone & Supply Company, of this city, have decided to consolidate with the Bell Telephone Company, of Harrisburg.

LIONVILLE, PA.—The Bell Telephone Company has now been rebuilt from Whitford to Lionville, with new poles and new copper wire, and is in first-class condition. It has been extended to Upper Uwchlan, where an exchange has been put in.

READING, PA.—The work of extending the Valley telephone system to Reading has been completed to a point near the city limits. This is a part of the Consolidated Telephone Company system, which is to embrace many counties in Eastern Pennsylvania.

COLUMBIA, S. C.—Practically all the telephone lines in this sections have been bought by the South Carolina Telephone Company, with headquarters at Columbia. This gives Batesburg, Leesville, Lexington, Johnston, Ridge Spring, Saluda and Edgefield telephone communication with the Capital City.

ALEXANDRIA, S. D.—The North telephone line, as now completed, has sixteen miles of wire up and accommodates seven subscribers, but many more are expected.

MITCHELL, S. D.—Poles have arrived for the construction of a telephone line from Mitchell to Woonsocket. The contractors agree to have the line completed by Sept. 1.

KNOXVILLE, TENN.—The People's Telephone & Telegraph Company has completed the laying of its conduits on Commerce Avenue and the connecting alleys. The experiment has proved so satisfactory that the company has decided to considerably extend its conduit system.

MEMPHIS, TENN.—The Cumberland Telephone & Telegraph Company has issued statement of its business for the month of June, 1901. The total number of subscribers June 1, 1901, was 65,691, and the net increase during June of 1,069, making 66,760 June 30.

SAN ANTONIO, TEX.—B. S. Bailey, of Wauseon, O., has just completed putting in new telephone systems at San Antonio, Tex.

EL PASO, TEX.—A $50,000 company has been organized in Cleveland, O., to install the telephone system for which franchise was granted recently to Mrs. Britt, of Chicago.

VERNON, TEX.—A company has been organized here to build a telephone line from this place to Quanah and Crowell, Tex., and Altus and Enid, Okla. Work will be begun at once.

FORT WORTH, TEX.—Representatives of seventeen independent telephone companies and exchanges in Texas, Indian Territory and Oklahoma have formed a permanent organization, with Ed Nims, of Roff, I. T., as president, and O. C. Betz, of Corsicana, as secretary. The telephone situation in Texas, Oklahoma and Indian Territory and extensions to the stock ranch region were fully discussed.

LEXINGTON, VA.—The Mutual Telephone system has been much damaged by storms.

SPOTTSYLVANIA, VA.—The work of stringing the wire and putting in the telephones on the line of the Spottsylvania Telephone Company from this point to Belmont and Lewiston has begun, all the poles now being in place.

SCOTTSVILLE, VA.—Mr. J. W. Gulley, of Staunton, is getting rights of way for the Virginia Long-Distance Telephone Company, with a view to putting in a line from Staunton to this place, then on to Richmond, taking in the most important points between.

LA CROSSE, WIS.—The new underground fire alarm system has been completed.

MONTELLO, WIS.—The telephone company has placed a new 100-drop switchboard at the central office in this village.

CHEYENNE, WYO.—The Rocky Mountain Bell Telephone Company has let contract for the distribution of the telephone poles to be used in the construction of the new line between Cheyenne and Casper.

LA CROSSE, WIS.—The Wisconsin Telephone Company is figuring on an exchange at West Salem, Wis. The present service on the toll board is said to be very poor, and the patrons there are desirous of having something better.

EAU CLAIRE, WIS.—The Osseo Telephone Company has been granted a franchise to construct a telephone system in Eau Claire. The plant is to be in operation in a year's time. A clause in the franchise prohibits it combining with any existing company.

BILLINGS, WYO.—The Wyoming extension of the Rocky Mountain Bell Telephone Company's lines is now being built between Billings and Big Timber. It will be built to Laurel, Red Lodge and Bridger this year and the remainder of the work will be left until next year.

SHEBOYGAN, WIS.—Alderman Teenies has prepared a series of rules and regulations for the granting of telephone franchises which will be adopted by the Council. The maximum rate of a rental for business houses must not exceed $2.50 and for private residences $1.50 a month.

ELECTRIC LIGHT AND POWER.

MOBILE, ALA.—The consolidation of the Mobile Light & Railroad Company, the Electric Lighting Company of Mobile and the Mobile Gas Light & Coke Company will take place Sept. 1. The consolidated company will adopt the name and charter of the Mobile Light & Railroad Company. The amount of capital stock and of the bonds to be issued by the consolidated company will be fixed at the time of consolidation—Sept. 1.

CAPE NOME, ALASKA.—A complete electric light plant is to be installed at Nome by Capt. F. N. Selberg, who is now purchasing the machinery for the plant. Equipped and in operation the plant will cost about $25,000. It will be owned and operated by the Nome Electric Light & Power Company, with Capt. Selberg as superintendent. Associated with him are some of the richest men in Nome. Every dollar of the stock is owned by Nome men. The company secured the necessary municipal franchise this spring, and last fall, before the granting of the light privileges, the poles were erected. It is expected to have the plant in operation by Sept. 1.

LOS ANGELES, CALIF.—The Equitable Gas & Electric Company was recently incorporated, with Los Angeles, Calif., as the principal place of business. Directors: S. A. W. Carver, A. Kinney, W. J. Washburn, J. D. Pope, W. F. Botsford, J. A Winans and W. L. Gillenen, all of Los Angeles. Capital stock, $1,000,000; subscribed, $8,000.

KESWICK, CALIF.—When the Keswick Power Company switches on its current its largest customer will be the Mountain Copper Company, of this place, which is the largest consumer of stationary power in Northern California. A large brick power station will be built at the smelter. Electricity will largely supersede the use of petroleum, which for the past year has been the chief fuel used by the smelter company.

BERKELEY, CALIF.—The Bay Counties Power Company, recently filed an application for a permanent franchise allowing it the right of running wires through Berkeley, Calif. The company has already run its pole line through the town under temporary franchise. The privilege is asked of maintaining wires in several streets for 99 years, the town to receive 2 per cent. of the gross receipts after five years. It is said that the Berkeley Electric Light Company has secured an agreement from the Bay Counties Company not to compete for local lighting for the first five years.

GEORGETOWN, COLO.—The new 50-ton concentrating mill of the Red Oak Company has started up and is operated by electric motors. Mrs. Teagarden, of Denver, turned on the electric current to start the machinery. The ore steadily improves in quantity and values, and a production of 100 tons per day will be an easy matter. The streak of solid lead ore is six feet wide, and there is an immense body of concentrating ore in connection with it. It is one of the biggest mines ever opened in Clear Creek County, and electric power has proved invaluable in developing it.

PARIS, FRANCE.—A $90,000 electric-lighting system is to be installed in the Church of Notre Dame in Paris.

GAINESVILLE, GA.—The Gainesville Power & Light Company has been chartered with a capital stock of $100,000. The stockholders are: F. L. Murray, Chicago; J. Spaulding, Atlanta; S. C. Dunlap, Z. T. Castleberry, H. H. Dean, Howard Thompson and C. E. Kimbrough.

INDIANAPOLIS, IND.—The Board of Public Works is advertising for bids for public electric lighting. The amended specifications, free from discrimination and with the confiscation clause stricken out, has been submitted to the local companies. No further resort to the court will be had.

JEFFERSONVILLE, IND.—The question who exactly owns the local light plant is doubtful. J. J. Walsh, who was the nominal president, is acting as receiver. The plant was built to sell to the city on the municipal ownership plan. Charges of bribery were made against members of the Council and the people repudiated the deal.

RICHMOND, IND.—An injunction suit has been brought in Richmond, Ind., by the Richmond Heat, Light & Power Company against the city of Richmond to enjoin the muicipality from erecting its own light plant. In the petition of the plaintiff it is averred that the municipality entered into a contract with it for it to furnish light for the city for a term of years.

CLINTON, ILL.—The electric light company of Clinton will furnish about 600 incandescent and twenty arc lights for the street fair.

COVINGTON, LA.—The St. Tammany Ice & Manufacturing Company, Limited, has its electric light plant in operation, and it gives perfect satisfaction.

MINNEAPOLIS, MINN.—The light committee of the Council is preparing to take up the matter of granting a franchise to the Black River Falls company to run wires into the city for the purpose of furnishing power for running small plants.

GLOSTER, MISS.—Work will soon begin on the electric light plant and water works.

BROOKFIELD, MO.—The Brookfield Gas, Electric & Heating Company, of Illinois, has filed evidence of incorporation, with a capital stock of $25,000, the capital to be employed in Missouri.

ST. LOUIS, MO.—A lighting contract was awarded by the Board of Public Improvements July 30. The Laclede Gas Company was awarded the lighting contract for one district for $8,000 and the Missouri Edison the other for $30,000. There was but one bid for each district and the contracts were awarded to the companies at their bids, which are lower than last year's prices.

ST. LOUIS, MO.—James Campbell, vice-president of the Laclede Gas Light Company, who has been engineering the deal for the sale of a controlling interest in the company to an Eastern syndicate, has announced that the deal is off. He stated that he had received a telegram July 31 from the president of the company, Emerson McMillin, to the effect that the syndicate which contemplated purchasing the Laclede Gas Light Company will be unable to pay certain money which was due Aug. 1, and asked for an extension. This Mr. Campbell was unwilling to grant, so wired that the deal was off.

NASHUA, N. H.—The annual meeting of the stockholders of the Nashua Light, Heat & Power Company was held recently. The following officers were elected by the directors: F. W. Estabrook, president; J. H. Tolles, clerk; Elbert Wheeler, treasurer; Walter F. Norton, superintendent of gas department; George L. Sadler, superintendent of electrical department.

PLYMOUTH, N. H.—The Plymouth Electric Light Company has held its annual meeting and some changes in the board have been made. James M. McCoy and Fred P. Weeks have come into control by buying up recently a majority of the stock, so that better results may be looked forward to in the near future. James N. McCoy was elected president, George H. Adams, clerk; Frank C. Calley, treasurer. It was voted that after Sept. 1 all users of electric lights would pay for their lights by meter.

POINT PLEASANT, N. J.—The Point Pleasant Light Company has won its fight to string wires in the borough of Bay Head, its right to do so having been questioned by the borough authorities.

TRENTON, N. J.—The Citizens' Light & Power Company has been incorporated at Trenton with an authorized capital of $1,500,000. Incorporators: William A. Jones, Melville A. Carpenter and Joseph B. Short, all of Newark.

POUGHKEEPSIE, N. Y.—The Consolidated Electric Light, Heat & Power Company, of Poughkeepsie, has been formed; capital, $200,000. Directors: James W. Hinkley, P. Frost Spaulding, Silas Hinkley and John Doheny, Poughkeepsie; William K. Roy, Wappingers Falls.

WARREN, O.—T. W. and E. W. Gilmer have been granted a franchise to erect and operate a steam heating and electric lighting plant.

COLUMBUS, O.—Judge Bigger, of the Common Pleas Court, has refused to issue an order restraining the Department of Public Work from issuing bonds in the sum of $110,000 for the purpose of building a city lighting plant.

YOUNGSTOWN, O.—Park & Hamilton, acting for the Penhale-De Vitt syndicate, which controls extensive lighting and railway properties in this vicinity, have secured options on the properties of the Greenville Electric Light & Steam Company, the Greenville Gas Company and the Greenville Water Works. The options are for sixty days and the price asked for the properties is said to aggregate $250,000.

TIFFIN, O.—The Tiffin, O., Light & Fuel Company, the Tiffin Electric Light Company and the Tiffin Gas Light Company have been consolidated. The new company will be known as the Consolidated Gas & Light Company. Besides the Tiffin concern the new company owns plants at Delphos, New Bremen and Minster, O. The incorporators are M. B. Dailey and C. F. M. Niles, of Toledo; D. M. Kirtley and J. H. Barr, of Detroit, and W. H. Dore, of Tiffin.

CINCINNATI, O.—The Business Men's Club, of this city, has begun the agitation of a question concerning an improvement of the local manufacturing situation as regards power facilities. New concerns locating here find their greatest difficulty in securing power. It has been suggested to the Cincinnati Gas & Electric Company that they fit up their smaller electric light plants, now being abandoned, and lease them to the medium and smaller manufacturing concerns that need power. The suggestion will probably be adopted.

BOWLING GREEN, O.—The Bowling Green Light & Power Company has secured a ten years extension of its franchise from Nov. 27, 1901. It has also renewed its contract with the city to furnish fifty-eight arc lamps at the rate of $7 per month and incandescents to be furnished private consumers at a rate of not more than ten cents per 1000 watts and $1 per month to be the minimum price. The company agrees to maintain a separate plant for lighting service so that the electric railway service will not interfere with the lighting circuit. New equipment will be installed at once.

CANTON, O.—A syndicate of capitalists supposed to be Detroit people are quietly working in Ohio to secure control of the lighting plants in a number of the leading centers. It is said that the company is to be known as the Electric Company of America, and it has been announced that it has secured a controlling interest in the property of the Canton Light, Heat & Power Company. Particulars of the deal have not been given out. At Fremont it is claimed the same people have secured control of the Northwestern Ohio Natural Gas Company, the Fremont Gas Company and the Fremont Electric Light & Power Company. It is stated that the new company will erect an extensive gas and power plant. The Fremont Electric Light & Power Company has recently closed a city contract to furnish light for ten years at $70 per year. It is said that the same people are negotiating for plants at Marion, Bellevue, Bowling Green, Massillon and other places.

LEBANON, ORE.—The town of Lebanon, Ore., recently closed a contract for lighting the streets with 1200-cp arc lamps, at the rate of $6.75 per light per month, on a twilight to daylight schedule.

KLAMATH FALLS, ORE.—The Klamath River Irrigation & Electric Company has completed its plans for taking water from the Klamath River for irrigating and generating electric power. The company, which was organized by J. F. Goeller, C. C. Maltey and E. J. Boyd, will install an electric light and power plant, with headquarters in Klamath Falls, Ore. The capital stock is $350,000.

PITTSBURG, PA.—The Edgewood Light, Heat & Power Company has been formed; capital, $1,000.

MERCHANTVILLE, PA.—The electric light system is now installed, and the streets are lighted by electricity for the first time by the arc system.

RED LION, PA.—At a recent election the stockholders of the Electric Light Company voted to increase their capital stock from $8,000 to $20,000. Work on the new plant is being pushed along vigorously.

SCRANTON, PA.—The charter for an electric light company has been applied for by a company, at the head of which is Mr. Allen, secretary of the International Correspondence Schools Company. The new concern will secure franchises from the boroughs of Dalton, Clark's Summitt, Clark's Green, Waverly, Glenburn and Factoryville. It is intended by the concern to provide all of the towns north of the mountain with electric light accommodations. The plant to generate the power will be located at Dalton and the lights will be incandescent.

RENOVO, PA.—The Pennsylvania Railroad Company will erect an immense new electric light plant on a site north of the blacksmith shop at Renovo in the near future. Besides furnishing electricity for lighting purposes throughout the shops, yards and Renovo passenger station, power will also be obtained to run some of the machinery in the machine and blacksmith shops.

LAKEWOOD, R. I.—Within a comparatively short time Lakewood will have electric lights. Locations have already been selected, and so soon as the poles can be fitted with arms the lights will be installed.

WAVERLY, TENN.—A charter has been granted an electric light company, which will put in a plant at an early date.

MT. PLEASANT, TEX.—The electric light plant has been destroyed by fire and all of the machinery ruined, which leaves the town in darkness for an indefinite period. The loss is estimated at $6,000, with only partial insurance.

RICHMOND, VA.—The new electric light plant for the city is nearing completion and will be ready for operation by Aug. 5. It will be an up-to-date plant in every respect.

CEDARBURG, WIS., will soon be lighted by electricity.

GRANTSBURG, WIS.—A $15,000 electric light plant will be established here.

JANESVILLE, WIS.—The Janesville Electric Company has let contracts for entirely duplicating its plant.

THE ELECTRIC RAILWAY.

HUNTSVILLE, ALA.—It is announced that the proposed sale of the Huntsville Electric Railway & Power Company to Baltimore parties has been confirmed. The system may be extended.

ATTALLA, ALA.—The Gadsden & Attalla Union Railway, an electric line between the above-named towns, has been sold. The purchasers were W. H. Weller and C. D. Ward, of Gadsden.

BIRMINGHAM, ALA.—George H. Davis, of New York, has reached Birmingham, and is ready to proceed with the $1,000,000 improvements contemplated by the Birmingham Railway, Light & Power Company, this company having recently absorbed the Consolidated Electric Light Company and the Birmingham Gas Company.

OAKLAND, CALIF.—It is reported on good authority that the Oakland, San Leandro & Haywards Electric Railway has passed into the control of W. G. Henshaw, president of the Union Savings Bank, Oakland, Calif.

SAN MATEO, CALIF.—The San Mateo Electric Railway Company, with headquarters in San Francisco, recently gave a statement to the State Board of Equalization, George E. Starr, secretary and treasurer, to the effect that $125,000 had been spent during the past year in improving the system. It is contemplated during the present year to extend the line from the present terminus to San Mateo, via Baden, and within a month cars will be put on to run to the end of the line at forty miles an hour, competing with the Southern Pacific Railroad.

ATLANTA, GA.—The Atlanta Railway & Power Company will file applications for extensive improvements in its tracks. Improvements in eight localities are projected.

GREENFIELD, IND.—A new depot is being erected here, and the electric line running into Spring Lake Park is being lengthened.

MUNCIE, IND.—The City Council has granted a franchise to the Newcastle & Greenfield Electric Company to enter the city with its line.

WABASH, IND.—The first cars of the Wabash River Traction Company have been run over the line. The cost of the road is somewhat in excess of $300,000.

MUNCIE, IND.—A mass meeting of farmers of Delaware and Henry counties has been called by the stockholders of the Muncie & Greenfield Electric Railway. The object is to impress the farmers with the importance of the road and to secure rights of way.

INDIANAPOLIS, IND.—A project is on foot by local capitalists for buying about two hundred acres of land in the northwestern corner of Hancock County and the northeastern corner of Marion County and converting it into a beautiful park. Either the Citizen's Electric line or the Indianapolis-Anderson Interurban line will build a road.

FT. WAYNE, IND.—General Manager Nelson, of the Ft. Wayne & Southwestern Traction Company, announces that cars will be running regularly between this city and Huntington soon; that the entire twenty-five miles of rail will be done by the 1st of August. He has been over the proposed extension from Huntington to Marion, via Wabash, Laro and Andrews.

INDIANAPOLIS, IND.—General Superintendent Ralph Peters, of the Pennsylvania lines, has been consulting with traffic officials in Indianapolis concerning an electric line to Martinsville. The Indianapolis & Vincennes track will be used. The constitution of the electric cars is to anticipate the Martinsville & Indianapolis electric line now being built. Arrangements are also under way to equip the Springfield and Xenia (Ohio) branch with electricity.

INDIANAPOLIS, IND.—The long talked of deal is finally closed and contracts have been made for the construction of the Indianapolis & Logansport interurban road, a New York capitalist having agreed to take the $2,000,000 of the bonds for $1,500,000, and to begin construction Aug. 1. A private right of way is secured for the most part. The road will be sixty-seven miles long and will connect a score of good towns and cities and pass through six of the best farming counties of the State.

LEXINGTON, KY.—A novel sight witnessed here July 26 was furnished by women acting as street car conductors. Fares were collected by girls of the various society sets. The affair was in the interest of Christ Church Guild, and street car parties were the particularly swell thing.

PITTSFIELD, MASS.—The Pittsfield Street Railway Company has been granted permission by the State Railroad Commissioners in Boston to run its tracks over private land in Lanesboro.

NILES, MICH.—Charles Chapin is preparing to utilize the power to be derived from his Buchanan dam for electric street railway purposes. The contract has been let for the enlargement of the race and the building of a new power house. The contract for a new electrical apparatus and water wheel was let a few days since.

JEFFERSON CITY, MO.—Secretary of State Cook has chartered the Inter-States & Leavenworth Railway Company, of Kansas City, with a capital of $500,000. The company is to operate a street railway in Kansas City and Jackson County, Mo., in Kansas City and Wyandotte County, Kan., and in Leavenworth and Leavenworth County, Kan.

RUTHERFORDTON, N. C.—Decatur Morrow is interested in a proposition to build an electric line to Chimney Rock, N. C., so that Asheville, N. C., can extend its electric line to that point, twenty-five miles, giving a railway from Asheville to Rutherfordton, connecting with the Seaboard Air Line. The estimated cost of the line is $400,000.

WILMINGTON, N. C.—It is reported that the Wilmington Seacoast Railroad to Wrightesville Beach has been sold to a syndicate and will be electrified. It is also thought that this is the first move in consolidating the line with the Wilmington Street Railway and the Wilmington Gas Light Company under a company headed by Hugh MacRae. Such a consolidation was authorized by the Legislature two years ago.

SYDNEY, N. S.—A Boston, Mass., syndicate has recently bought the ferries running between Sydney and North Sydney, in Cape Breton, Nova Scotia, as well as the Sydney electric light plant. The syndicate will at once commence the construction of an electric railway between Sydney and Glace Bay at a cost of $750,000.

PAINESVILLE, O.—The Fairport branch of the Cleveland, Painesville & Eastern Railway has been opened for business.

COLUMBUS, O.—The Newark, Zanesville & Coshocton Railway Company has applied to the State for lease of canal property.

GIBSONBURG, O.—Work has been started on a four-mile spur line from this place to the main line of the Toledo, Fremont & Norwalk Railway.

COLUMBUS, O.—The Columbus Railway Company is building at its shops here several large double truck cars for the Columbus and Westerville line.

WAUSEON, O.—The Fulton County Commissioners have granted a franchise through the county to the Toledo & Bryan Air Line Railway Company.

MT. GILEAD, O.—James Berry, a prominent business man of this place, is organizing a company and is securing right of way to build a line from Marion to Mt. Gilead.

STEUBENVILLE, O.—The Steubenville Traction & Light Company has awarded contracts for the erection of a new car barn and a new power house and repair shop.

DAYTON, O.—The Dayton & Northern Traction Company has completed the work of laying rails between Dayton & Greenville, and wires are being strung. The road will be in full operation before Aug. 15.

TIFFIN, O.—The Tiffin & Port Clinton Railway Company has won an important case where it brought suit to condemn land for electric railway purposes. It will have the effect of settling other similar cases.

HAMILTON, O.—Peter Schwab and others who are interested in the Southern Ohio Traction Company have organized the Eastern Indiana Traction Company to build a road from Richmond to Portland, Ind.

CINCINNATI, O.—The Traction Company is arranging to abandon one of the oldest lines in the city, the old Sycamore Street cable. Electric power will be substituted and the Sycamore Street Hill part abandoned.

RAVENNA, O.—The extension of the Northern Ohio Traction Company between this place and Kent is nearly completed and the line will be placed in operation the latter part of August in time for the annual county fair.

CLEVELAND, O.—R. Rosenstock & Company, engineers for the Findlay & Southern Railway Company, are completing plans and specifications for the equipment of the road and power house. Bids will be called for shortly.

CHILLICOTHE, O.—Grading has commenced on the Chillicothe & Hillsboro Traction Company's line. The contract for grading the Scioto Valley Traction Company's road to connect Chillicothe and Columbus has been let.

TOLEDO, O.—President Detwiler, of the Toledo & Maumee Valley Electric Railway Company, has announced that both lines operated by the company are to be double tracked, and that there is now no intention of selling the road.

THE CINCINNATI, O., ORPHAN ASYLUMS are to benefit at the hands of the Cincinnati Traction Company. The company furnishes special cars free and pays all expenses, including refreshments, on certain days of the week.

SPRINGFIELD, O.—H. W. Frey, of Springfield, and M. H. Collins, of South Charleston, are securing right of way for a road to extend from Springfield to Washington C. H., by way of South Charleston, Sedalia and Bloomingburg.

COLUMBUS, O.—The Columbus, Newark & Eastern Railway Company and the Columbus & Granville Traction Company have applied to the County Commissioners for a franchise over practically the same route between Columbus and Granville.

BRIDGEPORT, O.—S. White, of Mt. Pleasant, who has been promoting a line from Cadiz to Bridgeport, is reported to have consolidated his project with the Ohio Rapid Transit Company, which proposes to build from Martin's Ferry into Wheeling.

AKRON, O.—The Northern Ohio Traction Company has commenced construction work on its line to Massillon and Canton. The company has been unable to secure a franchise in Canton, but it has gained an important point in this direction.

VERSAILLES, O.—The people of this place are agitating in favor of an electric road. Right of way has already been secured through Bradford to Webster, nearby towns.

MARIETTA, O.—The Parkersburg & Marietta Electric Railway Company is advertising for bids for the construction work on twelve miles of line. C. H. Shattuck is president and J. M. Jackson, Parkersburg, W. Va., chief engineer for the company.

LEESBURG, O.—T. H. Hogsett, H. M. Huggins, A. Z. Blair and James McDermott have incorporated the Hillsboro & Ohio River Traction Company. They will build a line from Xenia to the Ohio River by way of Wilmington, New Vienna and Hillsboro.

DAYTON, O.—Col. George B. Kerper has resigned as general manager of the People's Railway Company, of this city, to devote his entire attention to the work of the Toledo, Bowling Green & Southern Railway, of which he has recently become chief owner.

NORWALK, O.—The City Council has granted a franchise to the Norwalk, Ashland & Southern Railway Company, enabling its line to enter the center of the city. The road will extend from Norwalk to Ashland, passing through North Fairfield, Fitchville and New London.

PIQUA, O.—Both the Western Ohio Railway Company and the Miami Valley Railway Company are pushing construction work on their lines north of this place. The roads will parallel each other for some distance, the former extending to Sidney and the latter to Minister.

CLEVELAND, OHIO.—The Hillsboro & Ohio River Traction Company has been incorporated by Henry M. Huggins, of Cincinnati; Thomas H. Hogsett and Charles Orr, of Cleveland, and Monroe Warner, James E. McDermot and O. Z. Blair, of Hillsboro. Capital stock, $10,000.

MARTIN'S FERRY, O.—The Steubenville, Mingoe & Ohio Valley Traction Company, the Wheeling Traction Company and the Ohio Valley Rapid Transit Company have applied for franchises in this place. It is probable that franchise will be granted giving all three joint use of the desired track.

COLUMBUS, O., is to have another electric railway, the Findlay & Southern, connecting Mt. Victory, Sommersville, Broadway, Marysville, Plain City and Columbus. Twenty-five-year franchise has been secured in Marysville and right of way through Union County. The road is to be completed by July 1, 1902.

COLUMBUS, O.—The contract for building the first section of the Scioto Valley Traction Company, between Columbus and Circleville, has been let to W. H. Luchtenburg, of Columbus, and F. B. McKinnon, of Toledo. A contract for the line between Ashville and Circleville was awarded to Row & Mowery.

HAMILTON, O.—The Hamilton, Glendale & Cincinnati Traction Company, a part of the Millcreek Valley Company, operating through lower Ohio towns into Cincinnati, will operate through the city of Hamilton. When completed the road will give a through schedule from Fountain Square, Cincinnati, to the Butler County seat.

COLUMBUS, O.—After waiting months for rails, the Columbus Railway Company has secured a large shipment and is pushing construction work with a large force on the Mt. Vernon Avenue line extension, which will connect at the city limits with the Columbus, New Albany & Johnstown Railway, now in process of construction.

TOLEDO, O.—The Michigan & Ohio Electric Railway Company, of which W. I. Robinson, of Detroit, is president, has placed conrtacts for grading; work to start within thirty days. The road will extend from Toledo to Maybee, Belleville, Romulus, Taylor and Encorse, Mich., with a branch to Detroit, and will have sixty-one miles of track.

TOLEDO, O.—The Everett-Moore syndicate, which now controls the properties of the Toledo Traction Company, has just purchased a tract of land 340 ft. on Beach Street and 100 ft. on Superior and Huron streets, on which will be erected an office building, freight and passenger station. It will be utilized by all the roads entering Toledo. Plans for the building are under way.

CLEVELAND, O.—Officials of the Cleveland & Eastern Railway Company, which is now dominated by the Everett-Moore syndicate, have incorporated the Chagrin Falls & Lake Erie Railroad Company, capital stock $100,000, for the purpose of building a line from Chagrin Falls to Willoughby, following the beautiful Chagrin River valley. It will connect three of the lines already in operation.

CINCINNATI, O.—Expert engineers and electricians of the traction company are planning to put all city lines underground. The cost, as estimated, will be about $1,000,000. The subject has been agitated by the street car people considerably of late years; the many steep grades which surround the city on all sides offering obstacles that have been believed by experts to be insurmountable.

COLUMBUS, O.—The Columbus, Buckeye Lake & Newark Traction Company has applied for further leases along the canal between Hebron and Newark. It has been found that for nearly two miles the road is on State canal property, whereas is has been supposed to be highway. The company has erected poles and strung wires for 7742 ft. on the road and wants the privilege of letting them remain where they are.

CINCINNATI, O.—The Cincinnati Traction Company will erect a magnificent fifteen-story home in that city, at the southeast corner of Fifth and Walnut streets, a commanding site. The building is to be patterned after that of the Widener-Elkins structure in Philadelphia, will cost $1,000,000 and be of steel frame construction, granite base and pressed brick and stone. The selected site is just across the way from the present offices, where the occupants are greatly cramped for room. The company gets a perpetual lease, with privilege of purchase at the end of twenty years, standing the company an annual rental of over $20,000.

LEGAL.

COMMON CARRIERS.—It has been decided by the Supreme Court of North Carolina that telephone companies are common carriers. They cannot discriminate by refusing to put their facilities at the disposal of any person who may offer to pay the usual charge for such service.

SUIT AS TO PATENT POLES.—Mr. John Mayer has filed suit in St. Louis for an injunction and accounting against the Imperial Electric, Heat, Light & Power Company and Lee G. Bruckman, general manager of the company, in the United States Circuit Court July 31. Mr. Mayer claims that he is the patentee of the poles used by the company for the suspension of their arc lights at street corners. Mr. Mayer charges that the Imperial is manufacturing and using these poles unlawfully.

THE AUTOMOBILE.

NEW YORK STATE.—The law enacted at the last session of the Legislature regarding automobiles has gone into effect. It limits the speed of all power vehicles to twelve miles an hour in cities and fifteen miles on the country roads. If the driver of a horse holds up his hand when meeting an automobile the chauffeur must stop instantly. A penalty of not more than $200 is attached to the statute.

TRIP TO TEXAS.—Mrs. Sarah Elizabeth Clark Decker and her husband have started from New York on a 2,000-mile trip to Beaumont, Tex., in a gasoline automobile. The route announced is to Jersey City, and through Asbury Park, Philadelphia, Washington, Richmond, Charleston, Macon, Pensacola, Mobile and New Orleans. The couple expect to complete their long ride in about seven weeks, making no effort to establish a speed record.

PERSONAL.

MR. H. BEVES, of the General Electric Company, Limited, of England, has returned to that country after a short stay on this side.

MR. J. E. Townsend, formerly manager of the Lima Electric Light & Power Company, has been appointed general manager of the lighting department of the Northern Ohio Traction Company.

PROF. GUSTAVE GILLON, of the University of Louvain, Belgium, has arrived in this country on a mission from the Belgian Government, and will make a study of electric railway development and electrical transmission of power.

MR. J. F. COLEMAN has resigned his connection with the City Engineer's Department of New Orleans in order to devote his entire time and energies to the business of the firm of Coleman & Malochée, consulting engineers of that place.

MR. J. E. WILSON, for nine years with the Pettingill-Andrews Company, and more recently with the Stuart-Howland Company, has organized the Electric Supply & Maintenance Company, 476 Eight Street, Troy, N. Y., of which company he is president.

GEN. EUGENE GRIFFIN, vice-president of the General Electric Company, has just made a flying trip to this country from England, where for some time to come he will find his most active occupation in connection with the British Thomson-Houston Company.

TRACY—TANNER.—The marriage of Mr. A. R. Tracy, electrical engineer to the State schools, at Faribault, Minn., to Miss Emily R. Tanner, took place last month at Minneapolis. The happy pair then left by way of the Great Lakes to spend a week at the Pan-American.

MR. L. TRUDEAU.—A cablegram has been received by Mr. L. Trudeau, of the Montreal Electric Street Railway, from Mr. Duncan McDonald, manager of the Paris street railway system, and formerly of Montreal, offering Mr. Trudeau the position of superintendent of tramways at Bordeaux.

SENOR ANGEL OLAZAGASTI, superintendent of the city electric lighting plant at Ponce, Porto Rico, was in Columbus, O., recently. He is making an inspection of the latest improvements in American electrical machinery and expects to make some purchases of new equipment for his plant.

MR. EPES RANDOLPH has been appointed general manager of the Los Angeles & Pasadena Electric Railway, which operates the Pacific Electric Railway and the Pasadena & Mt. Lowe Railway. Mr. Randolph's management will extend over all these roads. This appointment took effect Aug. 1.

MR. F. W. CH. JANISCH, engineer of works, etc., of the Siemens & Halske Company, of Berlin, is now visiting this country and hopes to spend a few months here inspecting and studying American methods and machinery. The company are in process of greatly extending their plant despite the generally dull times in Germany.

MR. S. C. THAYER, formerly president and general manager of the Columbiana County Telephone Company, Ohio, and until recently prominently identified with the Century Telephone Construction Company in its work in New York, has become general manager of the Bradford County Telephone Company at Tonawanda, N. Y.

MR. NELSON P. HUTCH, of Milwaukee, Wis., recently inspected the power possibilities of the Chats Rapids, near Ottawa, with a view to development. This magnificent, undeveloped power has been attracting great attention of late, and it will probably be all utilized before very long. It is one of the finest powers on the Ottawa River.

MISS HATTIE H. BEALS, telephone operator at Wichita, Kan., has won a homestead worth $25,000 in the Government distribution of land grants by lottery in Oklahoma, and she is going to mary C. V. Akerland, a trolley car conductor, at Wichita. Thus the good gifts of fortune will all remain in the electrical family, and neither of the happy pair will say "hello!" or "step lively!" hereafter.

MR. W. S. STROWGER, of Rochester, N. Y., who recently heralded a new storage battery, is now very enthusiastic about his "new liquid gas." It is

stated that he "has succeeded in liquefying it at pleasure and in producing it by cold chemical process. He can also compress it so that a quantity can be placed in a bottle, and by placing a pipe, with a gas burner on top, the tap may be turned and a brilliant light will result, just as though the regular gas of commerce were being used."

MR. FRED BATHURST returned to England last Wednesday, as noted, on the steamship *Teutonic*, after a professional tour of some weeks, during which he informed himself concerning the more recent developments in American electrical engineering. Upon going aboard the steamer Mr. and Mrs. Bathurst were pleasantly surprised by the many evidences of thoughtfulness on the part of American friends in the way of flowers and fruits.

MISS ANNA GETTINS, at present chief operator of the Youngstown, O., exchange of the Central Union Telephone Company (Bell), has been offered the position of traveling supervisor of exchanges throughout the entire State of Ohio. Miss Gettins has been with the Youngstown exchange for twelve years, and besides being an expert chief operator, she has an extensive mechanical knowledge of all the working of a system, both inside and out.

OBITUARY.

PROF. C. A. SCHOTT.—Washington dispatches announce the death there on July 31 of Prof. Charles A. Schott, for more than half a century an assistant in the United States Coast and Geodetic Survey, aged seventy-five years. Several years ago the French Academy conferred on him its highest honor—a medal for his researches in terrestrial magnetism. He was born at Manheim, Baden, Germany, Aug. 7, 1826. In 1847 he was graduated from the Polytechnic School at Carlsruhe. The following year he came to America and entered the Coast and Geodetic Survey. In 1856 he was promoted to the grade of an assistant in the service. Mr. Schott was a member of the Government parties that observed the total eclipse of the sun in August, 1869, at Springfield, Ill., and at Catania, Sicily, in December, 1870. In 1898 he was a delegate to the International Conference on Terrestrial Magnetism, which was held at Bristol, England. Mr. Schott was a member of many scientific societies, among them the National Academy of Sciences, Washington Academy of Sciences and the American Association for the Advancement of Science. He was also the author of many papers on hydrography, geodesy, tides and meteorology, and physics of the globe in Smithsonian Institute publications.

MR. W. H. JOHNSON.—We regret exceedingly to note the death at Louisville, Ky., of Mr. W. H. Johnson, a well-known electrician of the old school. He was born in Williamston, Mass., May 6, 1834. His father was a member of the State Legislature. The family moved to Troy, N. Y., where young Johnson was apprenticed to a firm of instrument makers. In 1855, at Cleveland, Mr. Johnson began his long connection with the telegraph service. He was at first in the manufacturing department of the Western Union, where he invented, it is said, the switchboard, which, in improved form, is now used in every Western Union office in the country. In 1859 Mr. Johnson was appointed superintendent of manufacture of the Southern Telegraph Company, with headquarters at Louisville. When the Southern was absorbed by the Western Union he was given a corresponding position at Louisville. He continued in the service of the Western Union for twenty-six years, until the department of manufacture was abolished. In 1882 Mr. Johnson organized the Louisville Electric Light Company and was its first secretary and manager. A year later he organized the Louisville Electrical Supply Company. He was chosen expert electrician for the Louisville Board of Fire Underwriters, and was the first inspector of electric lights and wires for the city. In 1889 he was appointed Deputy Collector of Internal Revenue for the district. He was one of the original stockholders and directors of the Ohio Valley Telephone Company, and retained his interests until the company sold out to the Cumberland Telephone & Telegraph Company. Mr. Johnson married Miss Anna Guyles, of Cleveland, who survives with one son, Mr. Shirley Everton Johnson, a well-known journalist. Mr. Johnson was a life member of Preston Lodge, No. 284, F. and A. M.; a K. of H., and a charter member of the Old Time Telegraphers' Association.

NEW INDUSTRIAL COMPANIES.

ROCHESTER, N. Y.—The Rochester Engineering & Supply Company has been formed to manufacture electrical machinery, etc. Capital, $5,000.

ONEIDA, N. Y.—The Oneida Automobile Company has been formed with a capital of $5,000, the directors being Theo. Coles, H. M. Reynolds and S. Allen Clark.

ROCHESTER, N. Y.—The Pullman Railroad Supply Company has been formed to manufacture and sell trolley catchers, electrical appliances, etc.; capital, appliances; capital, $20,000.

CHICAGO, ILL.—The La Salle Electric Company has been formed; capital, $9,000; manufacturing and deal in electrical supplies. Incorporators: P. L. Biggins, L. J. Gamwell, E. M. Hanes.

MODERN STREET LIGHTING COMPANY, of New York City, has been incorporated under the laws of Delaware to make and deal in articles for supplying light, heat and power. The capital stock is $100,000.

JERSEY CITY, N. J.—The Nathans Electrical Manufacturing Company has been formed to manufacture electrical machinery; capital, $125,000. Incorporators: Thos. A. Nathans, Frank L. Zabriskie, Edwin C. Ranney.

SOLVAY, N. Y.—The Pass & Seymour (Incorporated), of Solvay, Onondaga County, has been formed to manufacture electrical appliances; capital, $100,000. Directors: James Pass, A. P. Seymour and B. E. Salisbury, of Syracuse.

CAMDEN, N. J.—The Keystone Electric & Manufacturing Company has been formed. Principal office, New Jersey Corporation Guarantee & Trust Company Building, 419 Market Street, Camden, N. J. Objects, general electric and manufacturing business; capital, $250,000. Incorporators: Albert Schweitzer, A. Hausold, Samuel Brown.

STANDARD SIGNAL COMPANY, of Troy, has been formed to manufacture and install systems of interlocking block signals and safety appliances of every description for railoads; capital, $300,000. Directors: Alfred H. Renshaw and Palmer C. Rickett, Troy; Henry Burden, Jr., Cazenovia; John T. Cade, Ridgefield, N. J.; Harvey N. Loomis, New York.

BUTLER, PA.—The United States Electrical Supply Company has been organized at this place to manufacture telephones and telephone plants under patents of Dr. John W. Byers, of Butler. Under the new system thirty-five telephones will be operated by two wires and absolute secrecy is said to be possible. John W. Brown is president, M. A. Berkheimer, vice-president; W. H. Miller, secretary; Charles Bailey, treasurer, and Frederick E. Freers, general superintendent.

Trade Notes.

REMOVAL.—The Elk Dynamo & Motor Works have been removed from Newark to Belleville, N. J.

ARMOUR & CO. have just entered their third order for Cross oil filters, furnished by the Burt Manufacturing Company, of Akron, O.

ARC LAMPS.—Ordinarily the summer months are the dullest in the arc lamp business, but the Electric Appliance Company, Chicago, state that they have sold more A. B. arc lamps during the past two months than ever before.

ELECTRIC VEHICLE COMPANY have just issued a special bulletin, No. 12, showing what excellent service their electric automobiles rendered as ambulances, etc., in various places during the recent extremely hot weather. It makes most interesting trade literature.

THE CENTRAL ELECTRIC COMPANY, of Chicago, which has recently become Western sales agent for the Pittsburg Transformer Company's products, has issued a descriptive bulletin relating to the same. The Pittsburg Company's type "K" transfomer, made for both high and low frequencies, is well known by central station managers for its efficiency and superior workmanship.

PARAGON FAN & MOTOR COMPANY, 572-578 First Avenue, New York City, are actively distributing their recent circular relative to the Paragon enclosed multipolar apparatus in generators and motors. The circular is a pamphlet of 20 pages and gives a large amount of useful technical data as to this power machinery.

LAHMEYER APPARATUS.—The Elektrizitats-Actien-Gesellschaft, formerly W. Lahmeyer & Company, Frankfort-on-the-Main, Germany, send us a pamphlet which apparently was prepared in anticipation of the recent visit to its works by the English Institution of Electrical Engineers. The Catalogue is printed in English, and gives descriptions of all the more important types of apparatus made by this company, and views of some large electric railway and lighting plants which it has installed.

UNIVERSAL ELECTRICALLY DRIVEN GRINDERS.—The Anderson Tool Company, Anderson, Ind., has issued a 32-page catalogue devoted to its line of electrically-driven grinders. Nineteen excellent half-tone engravings show the Lea universal grinder applied to various uses. The Anderson Company makes three sizes of the universal type of grinder and three of a plain type. The final page of the catalogue illustrates the "L. H." enclosed arc lamp, which is manufactured by this company.

CORLISS ENGINES.—The Vilter Manufacturing Company, Milwaukee, Wis., in a new catalogue shows illustrations of the various types of Corliss engines of its manufacture. Views are also given of the large plant of the Vilter Company at Milwaukee, and an interior view of the main shop. About one-half of the catalogue is devoted to a list of plants using Corliss engines built by the Vilter Manufacturing Company, from which it appears that many are in service abroad, and particularly in Mexico.

VILTER MACHINERY.—The Vilter Manufacturing Company, Milwaukee, Wis., has recently closed a number of important contracts for Corliss steam engines and refrigerating and ice machines. Among the latter are 30 and 50-ton ice plants, and 25, 35 and 125-ton refrigerating plants. Among the engines are two 24x48x48, one 22x40x42 and one 14x28x36 cross compounds; three 18x42, two 22x42, and one 20x42 Corliss engines. The customers cover the States of Wisconsin, Kansas, Nebraska, Washington, D. C., Ohio, Illinois, Louisiana and Texas.

MECHANICAL DRAFT.—With the title, "Who Uses Mechanical Draft?" a 32-page pamphlet issued by the B. F. Sturtevant Company gives a partial list of those who use Sturtevant fans for induced draft. With the exception of a few words of explanation on the second cover page, the text consists entirely of names and addresses. The list of foreign boiler plants fitted with induced draft alone has more than 300 entries. The names of more than 200 vessels are given in which Sturtevant fans are used for mechanical draft, among which are over fifty United States war vessels.

STURTEVANT ENGINES.—The B. F. Sturtevant Company has issued the fourth edition of its illustrated catalogue of Sturtevant engines for electric light plants and general high-grade work. All the various types of Sturtevant engines are shown in excellent engravings, a number being represented direct-connected to electrical generators. The final pages give a useful table of horse power constants per revolution for different mean effective pressures; for single engines the range is from 2½x2-in. stroke to 18x16-in. stroke, and for double engines from 3½x2½-in. stroke to 9x5½-in. stroke.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, has recently issued an electric fixture and supply catalogue, which covers the most complete and up-to-date line of fixtures shown for some time. The fixtures are all illustrated by very large half-tones and the catalogue is very handsomely gotten up. The company states it has recently enlarged its facilities for handling the electric fixture business, and that its factory is now in position to guarantee prompt shipments of anything illustrated in their catalogue. Another recent publication of the same company is a small pamphlet devoted to lamp sockets and receptacles.

Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 30, 1901.

[Conducted by William A. Rosenbaum, Patent Attorney, 177 Times Bldg., N. Y.]

679,174. POWER FACTOR METER; Paul M. Lincoln, of Niagara Falls, N. Y. App. filed Mar. 27, 1901. (See Current News and Notes.)

679,175. FREQUENCY OR SPEED INDICATING AND REGULATING DEVICE; Paul M. Lincoln, of Niagara Falls, N. Y. App. filed Mar. 27, 1901. ((See Current News and Notes.)

679,304. ELECTRIC METER; Walter C. Fish, of Lynn, Mass. App. filed May 21, 1901. (See Current News and Notes.)

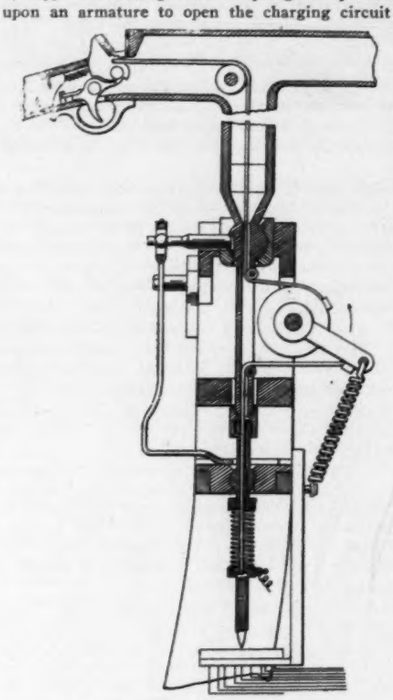
679,308. INSULATOR; H. Geisenhoner, Schenectady, N. Y. App. filed May 1, 1901. From the insulator is suspended a loop having overlapping parts similar to a key ring, between which the wire is passed to enter the loop.

679,310. SIGNAL SYSTEM; J. L. Hall, Schenectady, N. Y. App. filed Feb. 16, 1899. A marine signalling device consisting of a switch-controlled keyboard adapted to be moved bodily from one stand to another at different places on the ship, and readily make the necessary connections when put into position on any stand.

679,314. ELECTRIC RAILWAY; E. M. Hewlett, Schenectady, N. Y. App. filed Oct. 19, 1897. Means for reducing the amount of current which flows through the electromotive device actuating the switch controlling the working section.

679,316. ELECTRIC SWITCH SHELL.; H. Hubbell, Bridgeport, Conn. App. filed Jan. 28, 1901. Details.

679,321. AUTOMATIC SWITCH; F. Mackintosh, Schenectady, N. Y. App. filed May 1, 1899. An arrangement of springs co-operating with a magnet in acting upon an armature to open the charging circuit of a battery as



679,325.—Target Apparatus.

soon as the counter electromotive force of the battery has reached a certain value.

679,325. TARGET APPARATUS; J. L. McCullough, Brooklyn, N. Y. App. filed March 15, 1900. Circuits between a gun and a target are so controlled by the movements of the gun in aiming that the accuracy of the aim is electrically indicated when the trigger is pulled, without actually firing a projectile against the target. This provides for gun practice without wasting ammunition.

679,331. ELECTRIC RAILWAY SYSTEM; W. B. Potter, Schenectady, N. Y. App. filed Feb. 26, 1901. The aim of the invention is to provide a system having switches which are certain to open and close when required.

679,332. SURFACE CONTACT RAILWAY; W. B. Potter, Schenectady, N. Y. App. filed Jan. 9, 1899. The switch mechanism between the feeder and the working section comprises two or more switches adapted to be operated simultaneously.

679,333. ELECTRIC METER; Wm. H. Pratt, of Lynn, Mass. App. filed Apr. 22, 1901. (See Current News and Notes.)

679,357. APPARATUS FOR TREATING METALS BY ELECTROLYSIS; A. G. Betts, Upper Troy, N. Y. App. filed May 18, 1901. Apparatus for conveniently compressing, from time to time, the metallic electro deposit made upon the cathode.

679,362. ELECTRIC BRAKE; F. E. Case, Schenectady, N. Y. App. filed July 17, 1897. The brake system is so arranged and connected that whenever a brake shoe sticks a reverse current can be sent through the same to thereby demagnetize and release it.

679,405. MICROTELEPHONE; Emil Volkers, of Berlin, Germany. App. filed Mar. 22, 1901. A telephone receiver and transmitter are secured to the same standard or support; in each case the mechanism is embedded in an open box in a mass of liquable material, the diaphragms of both receiver and transmitter being located in practically the same plane. The object of the invention is to produce an apparatus of simple and economical construction, which, when once the parts are assembled, will not again require adjustment or regulation.

679,446. AUTOMATIC CIRCUIT CLOSER; G. A. Wall, Providence, R. I. App. filed Dec. 7, 1900. Details.

679,472. MULTI-RATE METER; Frank P. Cox and Charles E. Holmes, of Lynn, Mass. App. filed Dec. 4, 1899. (See Current News and Notes.)

679,476. ELECTROLYZING AND WASHING APPARATUS; J. F. Kelly, Pittsfield, Mass. App. filed Sept 14, 1900. The cell is forcibly reciprocated in order to carry the body of mercury from the electrolyzing chamber to the washing chamber without intimately mixing the amalgam.

679,477. ELECTROLYTIC DECOMPOSING CELL; J. W. Kynaston, Liverpool, England. App. filed Feb. 1, 1899. The cell comprises a series of superposed horizontal trays along which a stream of mercury flows to serve as a cathode of large surface.

679,700.—Arc. Lamp.

679,492. TROLLEY FOR ELECTRIC CARS; J. H. Beckert, St. Louis, Mo. App. filed Sept. 28, 1900. Apparatus is provided whereby the trolley is upwardly supported only when it is in contact with the wire.

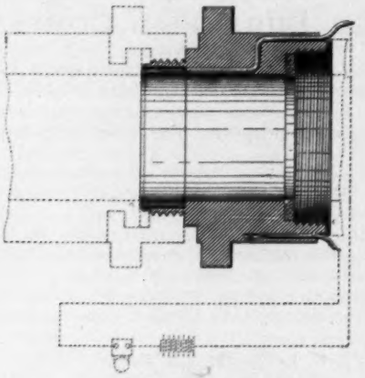
679,518. ELECTRICAL STOP FOR ENGINES; J. F. Skirrow, East Orange, N. J. App. filed Dec. 14, 1900. Details.

679,544. INSULATOR FOR ELECTRIC WIRES; J. E. Sharpe, Oneida, N. Y. App. filed May 17, 1901. The wire is held between the insulator and a plate, being clamped by a ring passing over the insulator.

679,546. SECONDARY ELECTRIC CLOCK; T. H. Wurmb and R. Bauman, St. Louis, Mo. App. filed Jan. 26, 1900. Details.

679,580. MEANS FOR ACTUATING INDICATORS UPON MOVING TRAINS; E. Vilpou, Blois, France. App. filed Feb. 23, 1900. Knives are arranged along the roadway in position to cut a cord stretched along the train when desired; cutting the cord operates an indicator at the locomotive.

679,615. UNDERGROUND ELECTRIC CONDUCTOR FOR STREET RAILWAYS; J. Floyd, Philadelphia, Pa. App. filed Nov. 21, 1900. An arrangement for maintaining a continuous circuit in passing over crossings.



11,924.—Hose Signal.

679,638. CIGAR CUTTER AND LIGHTER; C. A. Rosenholz, Wardner, Idaho. App. filed Feb. 14, 1901. Details.

679,654. BURGLAR ALARM; W. J. Wernette, Remus, Mich. App. filed Jan. 25, 1901. Details.

679,700. ELECTRIC ARC LAMP; S. M. Meyer, Brooklyn, N. Y. App. filed Oct. 10, 1900. The core of the solenoid is laminated both axially and transversely for the purpose of obtaining an increased traverse of a given size of core.

11,924. ELECTRIC HOSE SIGNAL SYSTEM; H. Sargent, Boston, Mass. App. filed Jan. 7, 1901. Relates to the construction of the connection at the hose coupling.